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Essays on Formation and Dissolution of Households

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Abstract in english

In Western Europe and the US, the last couple of decades have witnessed a large increase in the new forms of marriages, usually called quasi-marriages, like cohabitation. Today in many European countries more than 15% of all couples are cohabiting. Furthermore, cohabiting couples differ from married ones. They tend to share household tasks and market works more equally than married couples. The aim of the first chapter of the dissertation, "Will You Quasi-Marry Me? The Rise of Cohabitation and Decline of Marriages" is to account for the rise in cohabitation as well as the cross-sectional differences between cohabiting and married couples. To this end, a two-period model of marriage and cohabitation with home production is built. Using this framework, the relationship between the narrowing of the gender wage gap, the improvement in household production technology and the agents' marital decisions is analyzed, both theoretically and empirically.

The second chapter of the dissertation, "Peer Effects in Young Adults' Marital Decisions" studies peer group effects on marital decisions using data from Waves I and III of the National Longitudinal Study of Adolescent Health (Add Health). This database contains detailed information on adolescents' high school friends as well as their marital behavior later in life. A balanced panel for the years 1995-2002 is constructed using the calendar of all past and current relationships of the respondents. This procedure allows to recover the marital status of each individual and of her friends at any given year in order to analyze how the marital transitions of individuals depend on the marital status of their friends. The effect of peers on marital decisions is identified using panel data, instrumental variables techniques, and by exploiting the timing of friendship formation. The results after controlling for various observable characteristics of individuals and their friends show that peer effects in marital decisions are significant. Robustness checks using former and placebo friends support the results, and indicate that actual peers do matter.

The third chapter of the dissertation, "Young Adults living with their Parents and the Influence of peers" focuses on young adults living with their parents in the U.S. and studies the role of peers. Using data from the National Longitudinal Study of Adolescent Health (Add Health) the influence of high school friends on the coresidence of young adults with their parents is analyzed. The challenges in the identification of

peer effects in a static framework are addressed and are mitigated by employing an instrumental variable technique and controlling for state fixed effects. The analysis is then extended to a dynamic framework and exploits differences in the timing of leaving the parental home among peers. The results indicate that there are statistically significant peer effects on the nest-leaving behavior of young adults.

Resumen en castellano

En Europa Occidental y EE.UU., las últimas dos décadas han sido testigos de un gran aumento de las nuevas formas de matrimonio, generalmente llamados cuasi-matrimonios, como la cohabitación. Hoy en día, en muchos países de Europa, más del 15% de las parejas viven juntas sin casarse. Además, las parejas que deciden convivir con y sin matrimonio difieren en sus características sociodemográficas. Las parejas de hecho tienden a compartir las tareas de casa y el trabajo en el mercado en una manera más equitativa que las parejas casadas. El objetivo del primo capítulo de la tesis, "Will You Marry Me Quasi-Marry Me? The Rise of Cohabitation and Decline of Marriages" es explicar el aumento de la convivencia fuera del matrimonio, así como las diferencias entre convivientes y parejas casadas. Para este fin, construyo un modelo de dos periodos con matrimonio, convivencia y producción doméstica. Usando este contexto, analizo la relación entre la reducción de la brecha salarial de género, la mejora en la tecnología de producción de los hogares y las decisiones maritales de los agentes, tanto teóricamente como empíricamente.

El segundo capítulo de la tesis, "Peer Effects in Young Adults' Marital Decisions" estudia la influencia de los amigos a las decisiones maritales usando el Estudio Nacional Longitudinal de Salud Adolescente (Add Health). Esta base de datos contiene información detallada sobre los amigos de la secundaria, así como su comportamiento marital en el futuro. Construyo un panel para los años 1995-2002 utilizando el calendario de todas las relaciones pasadas y presentes de los encuestados. Este procedimiento me permite recuperar el estado civil de cada persona y de sus amigos en cualquier año con el fin de analizar cómo las transiciones maritales de personas dependen del estado civil de sus amigos. El efecto de los amigos a las decisiones maritales se identifica utilizando el panel de datos, técnicas de variables instrumentales, y aprovechando el momento de la formación de la amistad. Los resultados -controlando por diversas características observables de los individuos y sus amigos- muestran que la influencia de los amigos a las decisiones maritales es significativa. Pruebas de robustez con antiguos amigos y amigos "placebo" apoyan los resultados, e indican que los amigos reales son importantes.

El tercer capítulo de la tesis, "Young Adults Living with their Parents and the Influence of Peers " se centra en los adultos jóvenes que viven con sus padres en

los EE.UU. y la influencia de los amigos. Usando de nuevo los datos del Estudio Longitudinal Nacional de la Salud de los Adolescentes (Add Health) analizo el efecto de los amigos de la secundaria a la co-residencia de los adultos jóvenes con sus padres. Los retos de la identificación de este tipo de efectos en contexto estático se mitigan mediante el empleo de una técnica de variables instrumentales y controlando para el estado de residencia de los encuestados. El análisis se extiende luego a un marco dinámico y explota las diferencias en el momento de dejar la casa paterna entre amigos. Los resultados indican que existen efectos significativos de los amigos a la decisión de los adultos jóvenes de abandonar la casa paterna.

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Contents

Chapter 1. Will You 'Quasi-marry' Me? The Rise of Cohabitation and Decline of Marriages

1.1 Introduction

Family and household structure changed drastically in the last couple of decades. The marriage rate has declined sharply resulting in a shift in the composition of population by marital status towards never married. In the US the divorce rate has risen substantially. It has also increased more recently in many European countries like Italy, France, Germany, and Spain.

At the same period, the basic institution of marriage also underwent a big change. People have turned to more flexible forms of union. The decision to form a household with another person has been decoupled from the decision to marry, and *quasi marriages* have emerged as a new institution. In some countries cohabiting couples have the possibility to enter formal registration that will provide them with a virtually equivalent legal status to that of married couples (with some possible exceptions). Some examples of more formal types of quasi marriage are registered partnership in Belgium and pacte civile de solidarité in France. In most countries though, informal cohabitation is the only available form of quasi marriage. Both formal and informal cohabitation can be dissolved easily with minor costs and their dissolution rate is higher than the divorce rate (see Pison, 2008 for pacte civile de solidarité in France and Bumpass and Lu, 1989 and 2000 for informal cohabitation in the US).

But what factors are behind the shift towards quasi marriages? One possible factor is the dramatic increase in female labor force participation over the past decades. The increase started earlier in some countries (e.g. the US and the Nordic countries) but spread to the most of the OECD countries. In 2001 the participation rates of prime-age women range from less than 50% in many Southern European countries to well above 70% in Scandinavian, Central European countries, and the US (Jaumotte, 2003).

There is a large literature that studies the changes in female labor supply. Among possible factors one can list the diffusion of the contraceptive pill (Goldin and Katz,

2002), the narrowing of the gender wage gap (Jones et al., 2003), the cultural transmission of gender roles from mothers to sons (Fernández et al, 2004), and the improvement in the household production technology (Greenwood et al., 2005). More recently, Kaygusuz (2010) has emphasized the role of tax reforms, while Albanesi and Olivetti (2009b) have proposed medical progress as a potential factor. In this paper we focus on the narrowing of the gender wage gap and the improvement in the household production technology. These two factors may also be related with the agents' incentives to get married. The narrowing of the gender wage gap increases women's bargaining power and reduces the value to specialization within marriage. Improvements in household technology lead to a further decrease in the returns to specialization, and in the opportunity cost of not getting married (Greenwood and Guner, 2009).

The question we try to investigate is the relationship between the narrowing of the gender wage gap, the improvement in household production technology and the rise of cohabitation. The basic idea is as follows: In the past, women did not always work for pay, and their work was not always counted as work in the official statistics. Moreover, in the case they worked for pay, they used to earn less than men. Hence, marriage, which was more difficult to break than cohabitation due to the legal costs involved, was an attractive option for women (Becker, 1993). Men on the other hand were depending on women because of house work. Household production technology was not very progressed and it required a lot of time. Hence, a man would get married to a woman so as to use her time in house work and devote his own time to market work (specialization). Nowadays the conditions have changed. The gender wage gap has narrowed and household production technology has improved, weakening the incentives to enter a "secure" union for both men and women.

Of course, the improvement in the household production technology has started much earlier. One might expect that men would like to cohabit even then back in time. However, this alone was not enough in order to give rise to cohabitation. It is only when the gender wage gap started to narrow that women would consider a cohabitation proposal. In other words, these two factors had to act simultaneously.

The idea that the agents' decision about marriage is affected by economic reasons goes back to Becker (1993). According to Becker the major cause of the changes of the family (decrease in marriages) was the growth in the earning power of women as the American economy developed. Cohabitation is a more recent phenomenon and can be

cosidered as a continuation of this change. Oppenheimer (1994) instead, argues that it is the deterioration of young men's earnings that caused the increase in cohabitation.

The recent economic literature has proposed other possible causes of cohabitation. Stevenson and Wolfers (2007) report as possible driving forces the diminishing social stigma, and the lower value of formal marriage (through the unilateral divorce laws and marriage tax penalty on secondary earners). Social stigma though, can be endogenous. In this case, technological changes may as well affect its evolution in time. Taxes could play a role with the tax penalty acting as an enhancing factor for cohabitation. Chade and Ventura (2005) develop a search model with differential tax treatment of married and single people in the US. They also extend their model to include cohabitation. In their study cohabitors are taxed individually, as if they were single. However, it is worth noticing that in Nordic countries and the US the tax penalty on secondary earners has decreased during the last decades (Jaumotte, 2003). In the same period in the US the rate of cohabitation has doubled. In Italy and Spain, where the tax penalty has increased substantially, cohabiting couples are still a small minority (less than 5%). Lastly, there are countries like France and the Netherlands where cohabiting couples have the possibility of registering and therefore facing the same tax penalty as married couples.

The existing literature takes different paths to model the differences between marriage and cohabitation. Drewianka (2004 and 2006) attributes the difference in the level of commitment, while Cigno (2007), Wydick (2007), and Matoushek and Rasul (2008) adopt a game-theoretical framework where cohabitation arises as a non cooperative equilibrium and marriage as a cooperative one. In Cigno's (2007) framework, the equilibrium in the cooperative game is reached by Nash-bargaining while equilibrium in the non-cooperative game is Cournot-Nash and each party takes the other party's actions as given. Matoushek and Rasul (2008) show that marriage serves as a commitment device that fosters cooperation in an infinitely repeated prisoner's dilemma. In our setting cohabitation differs from marriage with respect to the probability and the cost of dissolution.

The transition from cohabitation to marriage has also been a matter of interest. Brien et al (2006) study cohabitation, marriage and divorce in the US using a model of learning of match quality. They perform quantitative analysis and show that cohabiting unions have higher dissolution probability than marriages and marriages that

are proceeded by cohabitation are less likely to last (selection effect). We treat cohabitation as a substitute and not as a precursor to marriage, i.e. we abstract from transitions into marriage.[1] Moreover, the need to learn the match quality is unlikely to explain why cohabitation has become common nowadays although it was rare in the past. Gemici and Laufer (2010) study the inefficiencies that might arise in cohabitation due to the lack of commitment. Using a model with household production technology they perform policy experiments, and assess the welfare implications of different institutional arrangements regarding divorce regulations.

Fertility, and in particular, unwanted pregnancy might also affect marital decisions. Christensen (2010) shows that the contraceptive pill was a catalyst that increased cohabitation's role in selecting marriage partners, but did little in the short run to promote cohabitation as a substitute for marriage. On the other hand, children might be important when considering the transitions from cohabitation into marriage, which is not the focus of this paper. We are interested in explaining why the formation of cohabiting unions has become popular in the first place, and we abstract from subsequent fertility decisions, that would complicate the model without adding much to the main objective of this paper.

There is also an empirical literature examining the factors that caused the increase in cohabitation. Kalmjin (2007) uses cross-sectional data for 27 countries in the mid 1990's and finds that female labor force participation as well as the percentage of the population with tertiary education affects positively cohabitation. The unemployment rate decreases cohabitation, while church membership does not have any statistically significant effect. Wydick (2007) also finds that female labor force participation increased cohabitation using data for the 50 states of the US in 1990 and 2000. In some specifications religion also seemed to play a significant negative role. The divorce rate, the mandated health insurance coverage of the contraception pill, as well as per capita abortions do not have any significant effect.

Our variables of interest, i.e. the gender wage gap and the improvement of house-

[1] In the model we do not consider the transitions from cohabitation into marriage, i.e. we treat cohabitation as a substitute and not as a precursor to marriage. This is because the main focus of the paper is to show why more and more couples nowadays decide to cohabit in the first place, while this was not so common in the past. The transitions could be modeled by introducing match quality in the model that evolves over time. The cohabiting couples whose match quality increases in the 2nd period get married and those whose match quality decreases separate. However, we expect that the main results of the paper would remain unaffected.

hold production technology are two of the factors that have been identified behind the increase in female employment. Greenwood et al (2005) study the effect of the new household production technology (through the declining prices and wider availability of home appliances) on female labor force participation. This effect is assessed empirically by Cavalcanti and Tavares (2008) using data for 17 OECD countries between the years 1975-1999. Their findings suggest that a decrease in the relative price of home appliances leads to a substantial and statistically significant increase in female labor force participation. Jones et al. (2003) find instead that it is the gender wage gap what drives the increase in female employment. The primer goal of these studies is to examine the factors behind female employment and they therefore treat marital decisions as exogenous without making any distinction between marriage and cohabitation. We endogenize the marital decision and we include cohabitation as an extra marital institution.

1.2 Motivation

1.2.1 Cohabitation, marriage rate and marital status of the population

Cohabitation has risen sharply during the last decade. Cohabitants as a percentage of all couples have doubled in the US during the last 20 years (Current Population Survey). The rate of cohabitation is nowadays around 20% or above in many European countries like Denmark, Finland, France, the Netherlands, Norway, and Sweden (Table 1).

Cohabitation serves either as a precursor or as a substitute for marriage. In the US, although most cohabitations do not end in marriage, most marriages are preceded by cohabitation (National Survey of Family Growth, 2002). Furthermore, one fifth of the cohabitations in the US in 2002 last more than 5 years, indicating that cohabitation can be permanent, and thus a substitute for marriage (Stevenson and Wolfers, 2007a).

Table 1

Cohabiting couples as percentage of all couples					
	1990's		2000's		% change
Austria	1997	9.1	2007	15.4	68.5
Belgium*			2007	11.1	NA
Denmark	1996	24.8	2006	24.4	-1.8
Finland	1995	18.5	2007	24.2	30.8
France	1995	14.6	2004	19.6	34.5
Germany	1996	8.5	2005	11.7	37.4
Ireland	1995	4.7	2006	14.1	202.8
Italy	1995	3.1	2006	4.5	45.1
Netherlands	1996	13.9	2008	19.3	38.7
Norway			2008	22.4	NA
Spain			2005	4.3	NA
Sweden	1995	23.4	2005	26.8	14.9
UK	1996	10.0	2006	16.0	59.9
US	1996	5.1	2008	10.4	105.7

Definition: two persons of different sex that share the same house and identify themselves as a couple (it excludes roommates, siblings etc)
Age group: All ages
Source: UNECE and National Statistical Services of each country

At the same time, the marriage rate has decreased substantially in many countries (Table 2). The crude marriage rate, i.e., the ratio of the number of marriages during the year to the average population in that year, has fallen more than 17% in Austria, France, Italy, the Netherlands, UK, and the US. Tables 1 and 2 indicate that more couples decide to cohabit instead of getting married.

Table 2

Crude marriage rate (per 1000 inhabitants)				
	1990's		2000's	
Austria	1995	5.4	2007	4.3
Belgium	1995	5.1	2007	4.3
Denmark	1995	6.6	2007	6.7
Finland	1995	4.7	2007	5.6
France	1995	9.1	2007	4.3
Germany	1995	5.3	2007	4.5
Ireland	1995	4.3	2007	5.2
Italy	1995	5.1	2007	4.2
Netherlands	1995	5.3	2007	4.3
Norway	1995	5.0	2007	5.0
Spain	1995	5.1	2007	4.5
Sweden	1995	3.8	2007	5.2
UK	1995	5.6	2007	4.4
US	1995	8.9	2007	7.3

Sources: National Vital Statistics (US) and Eurostat
Age group: All ages

The changes in the cohabitation and marriage rate are reflected in the composition of females by marital status (Table 3).[2] The married female population have decreased

[2]The pattern is similar for men.

in all countries, while the divorced and never married population have risen. Sweden and France have experienced the biggest drop in the percentage of married population, and nowadays more than half of the population is not married. In the US 10% of the population is divorced. In Italy, on the other hand, although divorced people are still a minority, they have doubled during the last decade.

Table 3

Marital Status of Female Population, 15 Years Old and Over in Percentages

Country	Marital Status	1993	2003	% Change
US	% married	56,4	54,0	-4,3
	% never married	22,9	25,3	10,5
	% divorced	9,6	10,9	13,5
Germany	% married	55,4	52,0	-6,1
	% never married	22,7	26,0	14,5
	% divorced	6,1	7,9	29,5
France	% married	51,3	46,5	-9,4
	% never married	27,5	30,8	12,0
	% divorced	5,6	7,5	33,9
Italy	% married	57,7	57,2	-0,9
	% never married	26,4	26,2	-0,8
	% divorced	1,0	1,7	70,0
Netherlands	% married	55,6	52,5	-5,6
	% never married	27,1	28,9	6,6
	% divorced	6,0	7,9	31,7
Sweden	% married	46,7	41,7	-10,7
	% never married	30,9	34,8	12,6
	% divorced	9,8	12,2	24,5

Sources:
Germany, France, Italy, Netherlands, and Sweden: generated from Eurostat
United States: U.S. Census Bureau

Tables 1 to 3 show a downward trend in marriage that has been accompanied by an upward trend towards unmarried cohabitation. The next step is to provide cross-country evidence for the relationship between cohabitation, gender wage gap and household production technology. This evidence will motivate the theoretical model and the numerical exercise that follow.

1.2.2 Cross-country evidence

There are scarce data on cohabitation. In the case of the US an appropriate estimate of cohabitation is available only after 1996. Before 1996 the estimates of unmarried couples also included households that had two unmarried adults of the opposite sex without identifying themselves as unmarried partners (Casper et al, 1999). United Nations Economic Commission for Europe (UNECE) provides some data on cohabitation but only for a few countries and years. We gathered our sample from the National Statistical Services of each country as well as from UNECE. We constructed

the rate of cohabitation as the number of cohabiting couples divided by the number of all couples.

Surprisingly, data on the gender wage gap is also difficult to find. Most data on wages are collected from firm surveys without making any distinction with respect to the gender of the employees. We constructed the gender wage gap as the difference of average male and female earnings divided by average male earnings using data from Eurostat, OECD and UNECE.

The relative price of home appliances is the price of home appliances as a ratio of CPI. Data are available from Eurostat for all years after 1995. This variable has been used in other studies (Cavalcanti and Tavares, 2008) as an indicator of household production technology. Our complete dataset is an unbalanced panel for 15 OECD countries in the period 1990-2008.

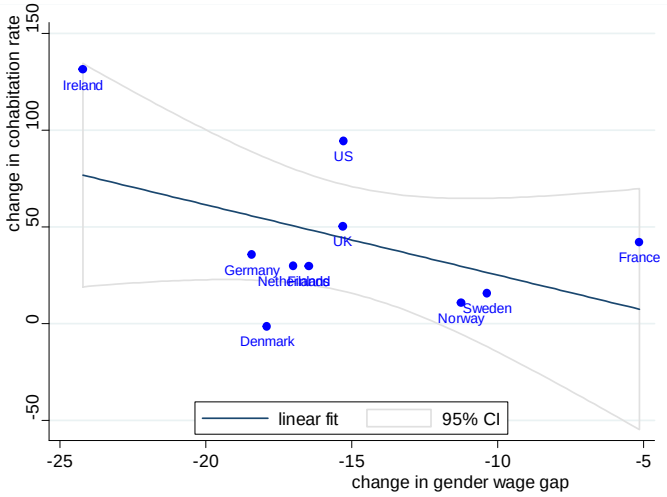

Figure 1

In Figure 1 we plot the change in the gender wage gap and the change in the rate of cohabitation during the last decade for a group of countries in our sample.[3] All data sources are explained in the Appendix. The gender wage gap is the difference between average earnings of male employees and of female employees as a percentage of average earnings of male employees. The rate of cohabitation refers to cohabiting

[3]For the figures we consider only the countries for which there are available data for both variables for a sufficiently long period. In particular, the periods covered are: Denmark: 1996-2005, Finland: 1995-2006, France: 1995-2005, Germany: 1996-2005, Ireland: 1995-2005, the Netherlands: 1996-2005, Norway: 2001-2008, Sweden: 1995-2004, UK: 1997-2006, and the US: 1996-2007.

couples as a percentage of all couples. Figure 1 indicates the existence of a negative relationship between the two variables that is further explored below.

Next we focus on the possible relationship between the relative price of home appliances and cohabitation. In Figure 2 we plot the change in the relative price of home appliances and the change in the cohabitation rate during the last decade for various countries.[4]The relative price of home appliances is measured as the ratio of the price of home appliances over the consumer price index. We use 1996 as base year. There is evidence of a negative relationship between the two variables, which is examined below.

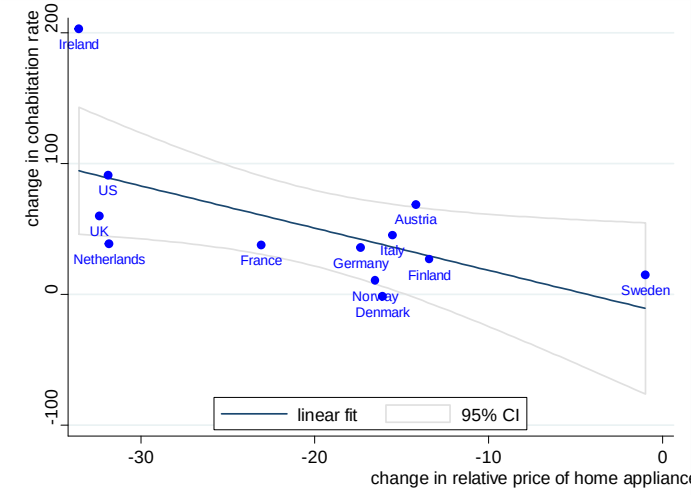

Figure 2

Figures 1 and 2 indicate the existence of a negative relationship between the rate of cohabitation and the gender wage gap as well as between the rate of cohabitation and the relative price of home appliance. We investigate the relation between the cohabitation rate on the one hand, and the gender wage gap and the relative price of home appliances on the other hand, using panel data regressions below. Our specification is

[4]The countries and periods of reference are: Austria: 1997-2007, Denmark: 1996-2006, Finland: 1996-2007, France: 1996-2005, Germany: 1996-2005, Ireland: 1995-2006, Italy: 1995-2006, the Netherlands: 1996-2008, Norway: 2001-2008, Sweden: 1995-2005, UK: 1996-2007, and the US: 1998-2008.

$$\begin{aligned}(\text{cohabitation rate})_{it} &= \alpha + \beta_0(\text{gender wage gap})_{it} \\ &\quad +\beta_1(\text{relative price of home appliances})_{it} \\ &\quad +\beta_2(\text{other controls})_{it} \end{aligned} \tag{1}$$

The vector of additional controls includes the annual percentage rate of GDP growth and the percentage of urban population. GDP growth reflects the degree of development of each country and it is expected to affect positively cohabitation. People who live in urban areas have usually less traditional stereotypes about marriage and are more open to changes than people in rural areas. This is why we expect it to have a positive effect on the rate of cohabitation. Summary statistics of the main variables of interest are shown in Table 4.

Table 4. Summary Statistics

	Obs.	Mean	Std. Dev.	Min	Max
Cohabitation	139	14.267	6.792	1.98	27.49
Gender wage gap	117	21.999	3.781	12.31	30.6
Relative price of home appliances	152	1.093	0.121	0.89	1.46

We first check the correlations between the three variables of interest (Table 5). There is a statistically significant negative correlation between the rate of cohabitation and the gender wage gap as well as between the rate of cohabitation and the price of home appliances.

Table 5. Correlations

	Cohabitation	Gender wage gap
Gender wage gap	-0.340***	
Relative price of home appliances	-0.286***	0.429***

We then estimate the model by OLS without including additional controls, using standard errors robust to heteroskedasticity. The results are presented in Table 6a. In all specifications both the relative price of home appliances and the gender wage gap have a negative and statistically significant effect as expected. Even when the

two variables are introduced in isolation (specification 1) they explain a good share in total variability in the rate of cohabitation. Their effect is robust to the inclusion of year dummies or time trend (specifications 2 and 3). We then include country dummies so as to capture country-specific differences in the rate of cohabitation. The coefficients remain negative and significant although they decrease in absolute value (specifications 4 and 5).[5] This is in accordance with Figures 1 and 2 where we verified that countries with the biggest change in the gender wage gap and the relative price of home appliances experienced the biggest change in the rate of cohabitation.

Table 6a. Determinants of Cohabitation-Ratio of All Couples

	(1)	(2)	(3)	(4)	(5)
Gender wage gap	-0.291**	-0.316**	-0.307**	-0.176**	-0.144**
	(0.141)	(0.124)	(0.142)	(0.078)	(0.072)
Relative price of home appliances	-18.49***	-60.81***	-62.84***	-9.00***	-5.34**
	(4.947)	(6.424)	(6.492)	(1.443)	(2.403)
Year dummies	No	No	Yes	No	Yes
Trend	No	Yes	No	No	No
Country dummies	No	No	No	Yes	Yes
N. of Observations	95	95	95	95	95
R^2	0.17	0.40	0.42	0.99	0.99

All specifications include a constant not reported. ** indicates significant at the 95% confidence level and *** at the 99%.

In the last specification the estimated elasticity for the average value of cohabitation and the gender wage gap is -0.198, i.e. on average, if the gender wage gap narrows by 15% this will lead to an increase in cohabitation by 2.97%. The estimated elasticity for the average value of cohabitation and the price of home appliances is almost double; -0.37. This means that a 15% decrease in the relative price of home appliances leads to an increase in cohabitation by 5.55%. The countries we study have experienced a decrease around 15% both in the gender wage gap and in the relative price of home appliances during the last decade. Germany, for instance, has experienced a 18.42% decrease in the gender wage gap and a 17.36% decrease in the relative price of home appliances. According to our estimates, such changes would imply an increase in the

[5]The results when the country dummies are included should be interpreted with caution due to the high value of R^2.

rate of cohabitation of about 3.64% and 6.42% respectively. Given that the rate of cohabitation in Germany increased by 35.56% from 1996 to 2005, the narrowing of the gender wage gap accounts for about 10% of the increase, and the decline in the relative price of home appliances for almost 20%.

We then included GDP growth and the percentage of urban population in all specifications but their coefficients were not statistically significant from zero. The results with respect to the variables of interest were not affected by the inclusion of any extra regressor.

Interestingly, religiosity does not seem to play any role either. The World Values Survey contains information on religiosity for various countries in 1990 and in 1999. We use two alternative measures of religiosity; the percentage of people who attend religious services more than once a week and the percentage of people who practically never attend religious services.

In Figures 3 and 4 we plot the percentage change in religiosity and the percentage change in cohabitation rate. There is no strong evidence of a relationship between the two variables.

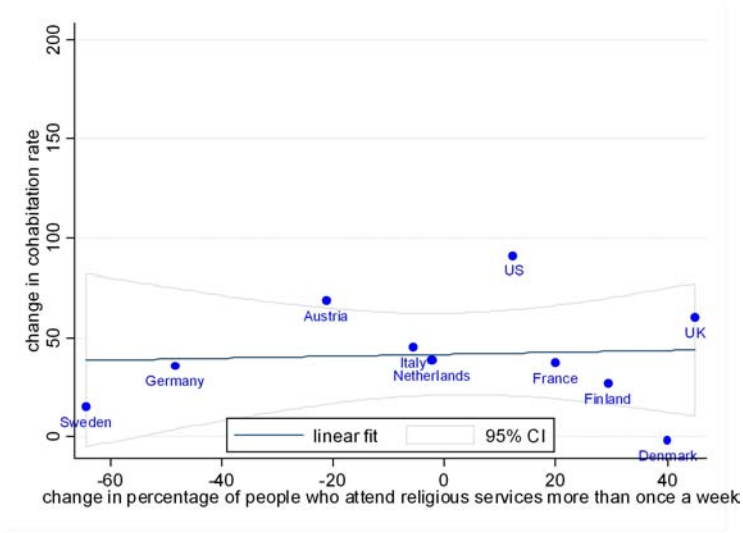

Figure 3

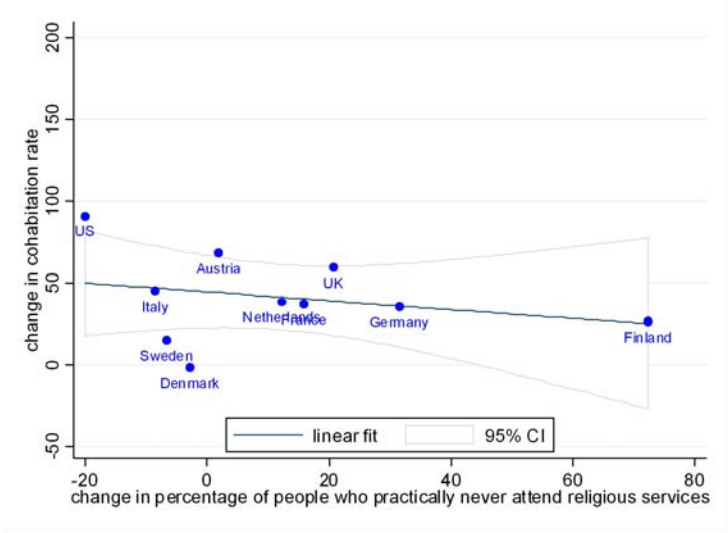

Figure 4

Finally, if we measure cohabitation as a ratio of all households instead of all couples, the gender wage gap loses its statistical significance (Table 6b). This indicates that the gender wage gap has an indirect effect on cohabitation through a decrease in the number of marriages.

Table 6b. Determinants of Cohabitation-Ratio of All Households

	(1)	(2)	(3)	(4)	(5)
Gender wage gap	-0.073	-0.081	-0.077	-0.049	-0.048
	(0.073)	(0.071)	(0.078)	(0.036)	(0.032)
Relative price of home appliances	-7.69***	24.71***	-25.06***	-4.94***	-4.15***
	(2.684)	(3.203)	(3.445)	(0.724)	(1.083)
Year dummies	No	No	Yes	No	Yes
Trend	No	Yes	No	No	No
Country dummies	No	No	No	Yes	Yes
N. of Observations	95	95	95	95	95
R^2	11.31	28.61	0.31	0.99	0.99

All specifications include a constant not reported. ** indicates significant at the 95% confidence level and *** at the 99%.

Before moving to the theoretical model though, it is important to see whether cohabitation is more common among specific groups of the population with respect to some characteristics (education, wealth, and employment status). The theoretical model that we develop is going to deliver these cross-sectional facts while accounting for the changes in cohabitation, gender wage gap, and household production technology.

1.2.3 Cross-sectional facts

Cohabiting and married couples differ along many dimensions. Cohabitation in the US is more common among poor and less educated partners (Bumpass and Sweet, 1989). This pattern is still observed in more recent data according to the report of Vital and Health Statistics (2010). Similar patterns are observed also in UK (Goodman and Greaves, 2010). Table 7 shows the percent distribution of women aged 15-44 in the US according to education and poverty characteristics. Married women seem to be more educated and richer than the cohabiting ones. There is a similar pattern also for men.

Furthermore married couples in the US are less alike with respect to hours worked and earnings when compared to cohabiting ones (Brines and Joyner, 1999 and Jepsen and Jepsen, 2002). Table 8 shows the percentage of cohabiting and married women, who report being a housewife as their main occupation. We use data from the 2002 International Social Survey Program (ISSP) on Family and Changing Gender Roles as it contains information on the relationship and occupational status of the respondents and of their partners.

Table 7

Percent distribution of women aged 15-44 by current marital or cohabiting status in the US

Characteristic	Married	Cohabiting
	Percent distribution	
Total	46.0	9.1
Education*		
No high school diploma or GED	49.1	17.2
High school diploma or GED	56.7	11.3
Some college, no bachelor's degree	57.4	7.6
Bachelor's degree or higher	62.9	5.4
Percent of poverty level*		
0-149%	40.9	13.0
0-99%	39.1	13.1
150-299%	60.4	9.9
300% or higher	66.5	6.4

Source: Vital and Health Statistics, Series 23, No. 28, February 2010 based on NSFG 2002 data
The percent of poverty level is based on the 2001 poverty levels defined by the U.S. Census Bureau
*Limited to women aged 22-44

In all countries except for Denmark the percentage of housewives is higher among married than among cohabiting women.[6] The traditional "woman at home-man in the market" pattern is more common among married couples. Cohabitation seems to be more symmetric, in the sense that both spouses work.

[6]The ISSP contains information on the occupation of both the respondent and the spouse/partner but information on age is limited to the respondent. This prohibits us from controlling for age since half of the observations are refered to the spouse/partner. Hence, a part of the difference in percentage of housewifes among cohabitors and married can be attributed to the older age of married women.

Table 8

Percentage of housewives

	Cohabiting women	Married women
Austria	11.89	26.36
Denmark	2.76	2.73
Finland	4.24	4.46
France	4.92	16.38
Germany	2.77	17.40
Ireland	9.52	39.07
Netherlands	10.53	32.19
Norway	6.62	7.37
Spain	15.71	49.60
Sweden	0.00	1.13
UK	14.79	16.90
US	15.56	26.25

Source: ISSP 2002 (own calculations)
Age group: all ages

In order to highlight the role of the gender wage gap and the price of home appliances in the rise of cohabitation, in the next section we build a model that can account for the changes in cohabitation and deliver the cross sectional facts that we have just discussed. This model will allow us to examine how the agents' decision to get married, cohabit or stay single are related with the narrowing of the gender wage gap and the improvement in the household production technology. These two factors will act through the female labor supply channel. Female labor supply will also be the key determinant of the cross sectional differences among married and cohabiting couples.

1.3 A Two-period Model

Consider the following model of marriage, cohabitation and divorce. Agents live for two periods. They are heterogeneous with respect to wages. Both men and women can work in the labor market but women are offered lower wages due to the gender wage gap. They derive utility from a market good and a good produced at home using durables and house work as inputs. In the 1st period they meet in pairs in the marriage market and the man may propose marriage or cohabitation to the woman through a take-it or leave-it offer. In the 2nd period couples face a probability of divorce. Cohabitation differs from marriage in terms of probability and cost of dissolution.

There is a continuum of males (m) and females (f), each of measure one. Agents discount time in rate $0 < \beta < 1$. Each agent has 1 unit of time and derives no utility from leisure. The utility function is additively separable of the form

$$U(c, h) = \mu \ln(c) + (1 - \mu) \ln(h),$$

where c is a market good and h a good produced at home.

There is a labor market where both men and women can work. There is heterogeneity in wages among men and among women. Men's wages w_m are drawn from a distribution F_{w_m} with support $[\underline{w}, \overline{w}]$. Women's wages are drawn from a distribution F_{w_f} with support $[\tau\underline{w}, \tau\overline{w}]$ and $\tau \in (0, 1)$ i.e. there is a gender wage gap. This difference in wages is exogenous[7]. There is a household production technology that transforms work at home into home produced goods h according to

$$h = A\left[\theta d^{\rho} + (1 - \theta)(1 - l)^{\rho}\right]^{1/\rho}, \ 0 < \rho < 1,$$

where d is the stock of household durables which are purchased in price q, l is labor supplied to the market (hence, $1-l$ is the time devoted to household production), A is technological progress and ρ determines the elasticity of substitution between durables and house work ($\frac{1}{1-\rho}$). We assume that durables purchased in the 1st period depreciate fully by the beginning of the 2nd period. Married/cohabiting men devote all of their available time to market work, while married/cohabiting women distribute their time between market work l_f and house work $(1 - l_f)$.[8]

There is also a marriage market where single people meet randomly potential partners of the opposite sex (who are also single). In the 1st period people meet in pairs. Upon meeting, the man makes take-it or leave-it offers to the woman.[9] Each offer consists of a sextuple $\left(c^i_{1f}, l^i_{1f}, d^i_1, c^i_{2f}, l^i_{2f}, d^i_2\right)$ where i is the type of marital institution, i.e. marriage or cohabitation. The offer will be a function of (w_m, w_f). Cohabitation differs from marriage with respect to the divorce cost. The divorce cost entailed with

[7] A possible extention is to endogenize the gender wage gap through the work experience channel (a form of human capital accumulation). See among others Albanesi and Olivetti (2009a), and Erosa et al. (2010).

[8] We relax this assumption by assuming that the man supplies a fixed amount of time to household production. For a reasonable amount (less than 20%) we get a very similar pattern of marital outcomes (See Appendix).

[9] This assumption is not critical. In the Appendix we analyze the case that the woman makes the take-it or leave-it offer to the man and the results are unaffected.

marriage ($\phi > 0$) is higher than the one entailed with cohabitation due to the law. We normalize the separation cost of cohabitors to zero. The woman can either accept the offer and enter into a union with the man, or reject the offer and remain single. The reason why agents would prefer entering a marital institution to singlehood is specialization. The woman will work at home in order to produce the household good and the man in the market where he earns more than the woman.

We assume that the good produced at home is a shared good for the couple with sharing parameter $\gamma \in \left[\frac{1}{2}, 1\right]$. Hence, if the amount of the household good produced is h, each partner will consume γh. As $\gamma \to 1$ there are economies of scale in the consumption of the household good. This is because the needs of a household grow with each additional member but not in a proportional way. Needs for housing space, electricity, etc will not be twice as high for a household with two members than for a single person.

In the 2nd period the agents who matched in the 1st period and have entered a union (marriage or cohabitation) face an exogenous probability of divorce π^m or separation π^c respectively, with $0 \leq \pi^m \leq 1$, $0 \leq \pi^c \leq 1$, and $\pi^m < \pi^c$.[10] We assume that divorced/separated agents do not rematch in the 2nd period. Agents who are single in the beginning of the 2nd period did not match in the 1st period waiting for a different match (in terms of wages). In the 2nd period single agents meet again in the marriage market. Upon meeting single men/women make/receive take-it or leave-it offers just like in the 1st period.[11]

Single agent's problem. Below we define and characterize the utility maximization problem of single and divorced agents and the optimal marriage/cohabitation proposal.[12] In the analysis that follows we set ρ equal to 0, i.e. we use a Cobb-Douglas production function in order to get analytical results. The problem of a single agent in the current period (1st or 2nd) is

[10] There is empirical evidence that cohabitations are more unstable than marriage (Bumpass and Sweet, 1989, and Bumpass and Lu, 2000). Alternatively we could endogenize the divorce decision by assuming that agents derive utility from a match quality that evolves over time. Also in this case cohabitation will be more unstable than marriage, since the couples that decide to cohabit will be the ones with low match quality (See Brien at el, 2006).

[11] Since there are only 2 periods the offer in the 2nd (last) period will be a triple (c_f^i, l_f^i, d_f^i).

[12] First order conditions can be obtained by the author upon request.

$$U(c_g^s(w_g), h_g^s(w_g)) = \max_{c_g^s>0, h_g^s>0, 0<l_g^s\leq 1, d_g^s>0} \mu \ln(c_g^s) + (1-\mu)\ln(h_g^s)$$

subject to

$$c_g^s = w_g l_g^s - q d_g^s,$$

and

$$h_g^s = A(d_g^s)^\theta (1-l_g^s),^{1-\theta}$$

where $g = m, f$ stands for male and female.

Combining the first order conditions, and the constraints we get

$$\begin{aligned} d_g^s &= \theta(1-\mu)\frac{w_g}{q}, && (2)\\ l_g^s &= \mu + \theta(1-\mu), && (3)\\ h_g^s &= A(\theta(1-\mu)\frac{w_g}{q})^\theta((1-\theta)(1-\mu)),^{1-\theta} && (4) \end{aligned}$$

and

$$c_g^s = \mu w_g. \quad (5)$$

Working hours are constant. Thus, improvements in household technology do not alter the amount of labour supplied by single agents. This is simply due to the Cobb-Douglas assumption, and with $\rho \neq 0$, improvements in household technology do affect working hours. The woman's reservation utility in the second period is then

$$U_f^s(w_f) = \mu \ln(\mu w_f) + (1-\mu)\ln(A(\theta(1-\mu)\frac{w_f}{q})^\theta((1-\theta)(1-\mu))^{1-\theta}). \quad (6)$$

The woman's reservation utility increases as her wage goes up or as the price of durables goes down. This is because the higher wage allows the single woman to buy more durables (remember that the labor supply is constant) and therefore to produce more household good. Lowering the price of durables has the same effect.

Divorced agent's problem. The problem that a divorced agent faces in the 2nd period depends on the divorce cost ϕ and is given by

$$U_g^d(w_g) = \max_{c_g^d>0, h_g^d>0, 0<l_g^d\leq 1, d_g^d>0} \mu \ln(c_g^d) + (1-\mu)\ln(h_g^d) \tag{7}$$

subject to

$$c_g^d = w_g l_g^d - q d_g^d - \phi,$$

and

$$h_g^d = A(d_g^d)^\theta (1-l_g^d)^{1-\theta},$$

where $g = m, f$ stands for male and female.

The first order conditions are

$$d_g^d = \theta(1-\mu)\frac{(w_g-\phi)}{q}, \tag{8}$$

$$l_g^d = \mu + \theta(1-\mu) + \frac{(1-\theta)(1-\mu)\phi}{w_g}, \tag{9}$$

$$h_g^d = A(\theta(1-\mu)\frac{(w_g-\phi)}{q})^\theta((1-\theta)(1-\mu)(1-\frac{\phi}{w_g})),^{1-\theta} \tag{10}$$

and

$$c_g^d = \mu(w_g-\phi). \tag{11}$$

The first order conditions are similar to the ones of the problem of a single man. The difference lies on the budget constraint, and in particular on the cost of divorce. The divorce cost decreases the quantity of the durable good and the quantity of the consumption good. Moreover, the labor supply is not constant as in the case of singles, but it depends negatively on the wage due to the fixed cost of divorce. More specifically, if the wage goes down the divorced agent will have to work more hours in order to cover the divorce cost.

Hence, the utility of a divorced agent is

$$U_g^d(w_g) = \mu\ln(\mu(w_g-\phi)) + (1-\mu)\ln(A(\theta(1-\mu)\frac{(w_g-\phi)}{q})^\theta((1-\theta)(1-\mu)(1-\frac{\phi}{w_g}))^{1-\theta}), \tag{12}$$

where $g = m, f$ stands for male and female.

There are also women who chose to remain single in the 1st period, waiting for a better match in the 2nd period. Let us define the expected utility that a woman will derive in the 2nd period, who was single in the 1st period by $V_f^2(w_f)$. She can either remain single in the 2nd period or enter a union (cohabitation or marriage). Her decision depends on the probability of meeting a man willing and able to make an acceptable proposal. Let $r^c = \int_{w_m \in W^c} dF(w_m)$ be the fraction of men who can propose cohabitation and $r^m = \int_{w_m \in W^m} dF(w_m)$ be the fraction of men who can propose marriage. Then,

$$\begin{aligned} V_f^2(w_f) &= (1-r^c-r^m)U_f^s(w_f) + \int_{w_m \in W^c} (\mu \ln(c_f^c) + (1-\mu)\ln(\gamma h^c)) dF(w_m) \\ &+ \int_{w_m \in W^m} (\mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m)) dF(w_m) \\ &= (1-r^c-r^m)U_f^s(w_f) + E_{r^c}(\mu \ln(c_f^c) + (1-\mu)\ln(\gamma h^c)) \\ &+ E_{r^m}(\mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m)) \\ &= (1-r^c-r^m)U_f^s(w_f) + r^c V_f^{2,c}(w_f) + r^m V_f^{2,m}(w_f), \ \forall \ w_m, \end{aligned} \tag{13}$$

where the last equality follows from the fact that no man can influence r^c, E_{r^c}, r^m, E_{r^m}, $U_f^s(w_f)$ and hence each woman of type w_f has a fixed reservation value for accepting a take-it or leave-it offer independently from the man's type w_m. The functions $V_f^{2,c}(w_f)$ and $V_f^{2,m}(w_f)$ are the utility that a woman, who was single in the 1st period, will derive in the 2nd period from cohabitation and marriage, respectively.

Since there is no possibility of divorce after the 2nd period the utility derived from marriage or cohabitation is the same for all men and for all women. Hence, $V_f^{2,m}(w_f) = V_f^{2,c}(w_f)$, i.e. women are indifferent between cohabitation and marriage. The only thing that matters for a woman is whether she receives a proposal or not. Let $r = r^m + r^c$. Then (13) becomes

$$\begin{aligned} V_f^2(w_f) &= (1-r)U_f^s(w_f) + rV_f^{2,m}(w_f) \\ &= (1-r)U_f^s(w_f) + r(\ln(c_f^m(w_f)) + (1-\mu)\ln(\gamma h^m(w_f))), \forall w_m. \end{aligned} \tag{13a}$$

Optimal marriage proposal in the 2nd period. Now let us define the problem of a man who wants to propose marriage/ cohabitation to a woman in the 2nd period given that the woman will accept the proposal (participation constraint). The problem consists of finding the triple $\left(c_f^m, l_f^m, d^m\right)$ that maximizes his utility given the budget constraint (BC), the household production technology (HPT), the woman's participation constraint (WPC), and the utility of the woman when single. It is given by

$$\max_{c_f^m>0, 0<l_f^m\leq 1, d^m>0} \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m) \tag{14}$$

subject to

$$\begin{aligned} c_m^m + c_f^m &= w_m + w_f l_f^m - q d^m, && \text{(BC)} \\ h^m &= A(d^m)^\theta (1-l_f^m)^{1-\theta}, && \text{(HPT)} \end{aligned}$$

and

$$U_f^s(w_f) \leq \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m), \tag{WPC}$$

where $U_f^s(w_f)$ is given by (6).

Combining the first order conditions and the constraints,[13] we get

$$\begin{aligned} d^m &= \frac{(1-\mu)\theta(w_f+w_m)}{q}, && (15) \\ l_f^m &= (\mu + (1-\mu)\theta) - (1-\mu)(1-\theta)\frac{w_m}{w_f}, && (16) \end{aligned}$$

and

$$h^m = A(\frac{(1-\mu)\theta(w_f+w_m)}{q})^\theta((1-\mu)(1-\theta)(1+\frac{w_m}{w_f})).^{1-\theta} \tag{17}$$

Given the Cobb-Douglas assumption, the labor supply of a married/cohabiting woman does not depend on A and q. Hence, improvements in the household production technology only increase the quantity of purchased durables and therefore the quantity of the home good produced. However, in contrast to the case of singles, the labor supply of the married/cohabiting woman depends on both her own wage (positively)

[13] See the Appendix for the derivations of the first order conditions. Corner solutions can be obtained by the author upon request.

and on the wage of her spouse (negatively). Hence, changes in the gender wage gap will have an impact on female labor supply.

The WPC will always bind, since the man has all the bargaining power. Hence, even if the woman accepts the proposal in the 2nd period her utility will not alter (it will exactly match her reservation utility $U_f^s(w_f)$ in singlehood). The man, however, can be better off if the woman accepts the proposal, thanks to specialization. Therefore,

$$U_f^s(w_f) = \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m).$$

Then,

$$c_f^m = \exp\left(\frac{1}{\mu}U_f^s(w_f) - \frac{(1-\mu)}{\mu}\ln(\gamma h^m)\right), \tag{18}$$

where $U_f^s(w_f)$ and h^m are given by (6) and (17) respectively. Then (13a) becomes

$$\begin{aligned} V_f^2(w_f) &= (1-r)U_f^s(w_f) + rV_f^{2,m}(w_f) \\ &= (1-r)U_f^s(w_f) + rU_f^s(w_f) = U_f^s(w_f) \\ &= \mu\ln(\mu w_f) + (1-\mu)\ln(\gamma A(\theta(1-\mu)\frac{w_f}{q})^\theta((1-\theta)(1-\mu))^{1-\theta}). \end{aligned} \tag{19}$$

Although the utility that the woman will derive in a union will be the same as the utility that she derives in singlehood, the allocation will differ, i.e. $c_f^s \neq c_f^m$ and $h_f^s \neq h^m$. In particular, using (4), (5), (17) and (18), we get

$$\mu \ln c_f^m - \mu \ln c_f^s = (1-\mu)\left[\ln w_f - \ln(w_f + w_m) - \ln\gamma\right] < 0 \tag{20}$$

and

$$(1-\mu)\ln\gamma h_f^m - (1-\mu)\ln h_f^s = (1-\mu)\left[\ln(w_f+w_m) - \ln w_f + \ln\gamma\right] > 0, \tag{21}$$

$\forall\gamma \in \left[\frac{w_f}{w_f+w_m}, 1\right]$, i.e. a woman who decides to get married or cohabit in the 2nd period will consume less consumption good but more household good than if she had stayed single. The increase in the household good exactly compensates for the decrease in the consumption good.

Optimal marital status in the 2nd period. Is it possible that marriage/cohabitation will not be feasible in the 2nd period? It may be the case that a man is better off single, so he will not be willing to propose to the woman. It may also be the case that the man is not able to propose because his budget is not enough so as to satisfy the woman's participation constraint, and make her accept his proposal. Both cases depend on the combination of w_f and w_m. Formally, marriage/cohabitation in the 2nd period is not feasible if the man is better off single, i.e.

$$U_m^s(w_m) > \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m),$$

or if he cannot satisfy the WPC, i.e. both

$$U_f^s(w_f) = \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m),$$

and

$$c_m^m + c_f^m \leq w_m + w_f l_f^m - q d^m$$

cannot hold simultaneously with

$$c_m^m > 0, c_f^m > 0, 0 \leq l_f^m < 1, d^m > 0, h^m > 0.$$

Optimal marriage proposal in the 1st period. Now let us focus on the optimal marriage proposal in the 1st period. A man who wants to propose marriage to a woman in the 1st period has also to consider the probability and the cost of divorce. His offer is renegotiation-proof; even if we allow for renegotiation, the man will have no incentive to change his offer in the 2nd period because the woman's participation constraint will always bind. The problem consists of finding the vector $\left(c_f^{1,m}, l_f^{1,m}, d^{1,m}, c_f^{2,m}, l_f^{2,m}, d^{2,m}\right)$ that maximizes his utility given the budget constraint in each period (BC1) and (BC2), the household production technology in each period (HPT1) and (HPT2), the woman's participation constraint in each period (WPC1) and (WPC2), as well as his utility if divorced, the utility of the woman when single, and the utility of the woman if divorced

$$\max_{c_f^{1,m}>0,0<l_f^{1,m}<1,d^{1,m}>0,c_f^{2,m}>0,0<l_f^{2,m}<1,d^{2,m}>0,} \mu \ln(c_m^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) + \beta\left[(1-\pi^m)\left(\mu\ln(c_m^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_m^d(w_m)\right]$$

subject to

$$\begin{aligned} c_m^{1,m} + c_f^{1,m} &= w_m + w_f l_f^{1,m} - q d^{1,m}, && \text{(BC1)} \\ c_m^{2,m} + c_f^{2,m} &= w_m + w_f l_f^{2,m} - q d^{2,m}, && \text{(BC2)} \\ h^{1,m} &= A(d^{1,m})^\theta (1-l_f^{1,m})^{1-\theta}, && \text{(HPT1)} \\ h^{2,m} &= A(d^{2,m})^\theta (1-l_f^{2,m})^{1-\theta}, && \text{(HPT2)} \end{aligned}$$

$$\begin{aligned} (1+\beta)U_f^s(w_f) \leq\ & \mu\ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ & +\beta[(1-\pi^m)\left(\mu\ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_f^d(w_f)], \end{aligned} \quad \text{(WPC1)}$$

and

$$U_f^s(w_f) \leq \mu\ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m}), \quad \text{(WPC2)}$$

where $U_f^s(w_f)$ is given by (6), and $U_m^d(w_m)$ and $U_f^d(w_f)$ are given by (12).

Combining the first order conditions and the constraints we find that

$$d^{1,m} = d^{2,m},$$

and

$$l_f^{1,m} = l_f^{2,m},$$

and therefore

$$h^{1,m} = h^{2,m}.$$

Thus, the man's take-it or leave-it offer to the woman will entail the same amount of durables, hours of market work, and therefore hours of housework and household good as the ones we found when we characterized the 2nd period (15)-(17). Moreover, the consumption good he offers to the woman in the 2nd period ($c_f^{2,m}$) will again be given by (18) since the woman's participation constraint in the 2nd period (WPC2) is the same.

The difference lies on the amount of consumption good offered in the 1st period ($c_f^{1,m}$). The man will have to offer as much $c_f^{1,m}$ as it is necessary so as to satisfy the woman's participation constraint in the 1st period (WPC1). However, the woman's participation constraint in the 1st period differs from the one in the 2nd period because of the dissolution probability and its resulting cost. Again, the man will exactly match the woman's reservation utility because he has all the bargaining power

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ + \beta[(1-\pi^m)\left(\mu \ln(c_f^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_f^d(w_f)].$$

Taking into account that the woman's participation constraint will bind also in the 2nd period we get

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,m}) + (1-\mu)\ln(\gamma h^{1m}) + \beta[(1-\pi^m)\, U_f^s(w_f) + \pi^m U_f^d(w_f)],$$

and therefore

$$c_f^{1,m} = \exp\left[\frac{1}{\mu}\left(U_f^s(w_f) - (1-\mu)\ln(\gamma h_1^m) + \beta\pi^m(U_f^s(w_f) - U_f^d(w_f))\right)\right]. \qquad (22)$$

Equation (22) completes the characterization of the optimal marriage proposal. The next step is to characterize the optimal cohabitation proposal. Only then the man will be able to determine his optimal marital status.

Optimal cohabitation proposal. The problem of the optimal cohabitation proposal in the 1st period is the same as the one of the optimal marriage proposal, but

without any divorce cost ($\phi = 0$) and with higher dissolution probability $\pi_c > \pi_m$.

Hence, in both periods, the man will offer to the woman the same amount of durables (d^c), hours of market work (l_f^c), and therefore hours of housework ($1 - l_f^c$) and household good (h^c) as the ones of the marriage proposal (15)-(17). The amount of consumption good offered in the 2nd period ($c_f^{2,c}$) will be given by (18).

What about the amount of consumption good in the 1st period ($c_f^{1,c}$)? The man will have to offer as much $c_f^{1,c}$ as it is necessary so as to exactly match the woman's reservation utility. However, the woman's participation constraint differs from the one in marriage in terms of dissolution probability and cost.

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,c}) + (1-\mu)\ln(\gamma h^{1,c}) \\ + \beta[(1-\pi^c)\left(\mu \ln(c_f^{2,c}) + (1-\mu)\ln(\gamma h^{2,c})\right) + \pi^c U_f^s(w_f)],$$

which can be written as

$$(1+\beta)U_f^s(w_f) = \mu \ln(c_f^{1,c}) + (1-\mu)\ln(\gamma h^{1c}) + \beta[(1-\pi^c)\, U_f^s(w_f) + \pi^c U_f^s(w_f)].$$

This simplifies into

$$U_f^s(w_f) = \mu \ln(c_f^{1,c}) + (1-\mu)\ln(\gamma h^{1,c}),$$

from which we get

$$c_f^{1,c} = \exp\left(\frac{1}{\mu}(U_f^s(w_f) - (1-\mu)\ln(\gamma h^{1,m}))\right) = c_f^{2,c}. \tag{23}$$

Hence, if the man wants to propose cohabitation to the woman in the 1st period he has to make the same offer as in the 2nd period. Contrary to the marriage offer, the man will offer the same amount of consumption good to the woman in both periods. This is because in the case of cohabitation there is no dissolution cost. If there was no divorce cost in the case of marriage, equations (22) and (23) would be equal, and as a result, the proposal of marriage would be identical to the proposal of cohabitation. With positive divorce cost though, $U_f^s(w_f) > U_f^d(w_f)$ in (22) which yields $c_f^{1,m} > c_f^{1,c}$,

i.e. the man has to offer more consumption good to the woman in marriage than in cohabitation (in this way the man compensates the woman for possible divorce costs).

Optimal marital status in the 1st period. In order to determine the optimal marital status the man has to compare his utility in singlehood to his utility in cohabitation and to his utility in marriage. In the two latter cases he should be able to satisfy the woman's participation constraint or else singlehood is the only possible option. Singlehood is optimal if the man is better off single, i.e.

$$\begin{aligned}(1+\beta)U_m^s(w_m) \;>\; & \mu\ln(c_m^{1,m}) + (1-\mu)\ln(\gamma h^{1,m}) \\ & +\beta[(1-\pi^m)\left(\mu\ln(c_m^{2,m}) + (1-\mu)\ln(\gamma h^{2,m})\right) + \pi^m U_m^d(w_m)],\end{aligned}$$

and

$$\begin{aligned}(1+\beta)U_m^s(w_m) \;>\; & \mu\ln(c_m^{1,c}) + (1-\mu)\ln(\gamma h^{1,c}) \\ & +\beta[(1-\pi^c)\left(\mu\ln(c_m^{2,c}) + (1-\mu)\ln(\gamma h^{2,c})\right) + \pi^c U_m^c(w_m)],\end{aligned}$$

or if he cannot satisfy the WPC in marriage and cohabitation in any of the two periods, i.e.

$$c_m^{t,m} + c_f^{t,m} \leq w_m + w_f l_f^{t,m} - qd^{t,m}$$

cannot hold simultaneously with

$$c_m^{t,m} > 0, c_f^{t,m} > 0, 0 \leq l_f^{t,m} < 1, d^{t,m} > 0, h^{t,m} > 0$$

for some $t = 1, 2$ and

$$c_m^{t,c} + c_f^{t,c} \leq w_m + w_f l_f^{t,c} - qd^{t,c}$$

cannot hold simultaneously with

$$c_m^{t,c} > 0, c_f^{t,c} > 0, 0 \leq l_f^{t,c} < 1, d^{t,c} > 0, h^{t,c} > 0$$

for some $t = 1, 2$.

Marriage is optimal if the man is better off married, i.e. his discounted utility in marriage for both periods is higher than his discounted utility in singlehood and his discounted utility in cohabitation. Similarly for cohabitation.

Up to now we have set up and solved a model of marriage and cohabitation, whose main ingredients are the gender wage gap and the household production. We showed that the man will propose marriage or cohabitation to a woman in order to maximize his utility. In the case that the woman's reservation utility is too high, matching may not be feasible. The outcome will depend on the combination of wages of each prospective couple (w_m, w_f). In the following section we examine marital outcomes for different combinations of male and female wages.

1.4 Numerical Example

As it became clear from the theoretical model, the optimal marital status of the agents depends on the combination of wages of the prospective couple. In other words, when a man meets a woman, he will either propose marriage or cohabitation to her, or he will prefer to stay single, or he will not even be able to propose. The outcome will depend on the combination of their wages. In order to get a better understanding of the mechanics of the model we solve a numerical example using the parameter values in Table 9.

We have not picked these values so as to match any data, i.e. we do not calibrate the model. Still, we have chosen them in a way that gives predictions close to the data estimates. Such a simple model can actually deliver the cross-sectional facts that are observed in the data and accounts for the rise in cohabitation. Our benchmark is the US economy in 2008. The value of the discount rate $\beta = 0.96$ is standard in the literature. We assume that the agents value the consumption good as much as the household good and we set their weights equal, i.e. $\mu = 0.5$. We set $\gamma = 1.7$ following the equivalence scale proposed by OECD (1 for the first member of the household, 0.7 for the second). The probability of dissolution in cohabitation is set almost double than the probability of divorce in marriage. In particular, we set the probability of divorce for married couples $\pi_m = 0.30$ following Stevenson and Wolfers (2007b). For cohabiting couples we set the probability of dissolution $\pi_c = 0.50$;

according to the report of Vital and Health Statistics (2010) about half of cohabiting unions do not survive after 1 year of cohabitation. Setting $A = 20$ in the household production function and $q = 2$ for the price of durables gives an average share of expenditure on durables over labor income equal to 21% which is in accordance with recent estimates (Baxter and Rotz, 2009). The divorce cost ϕ is set equal to 3.5 in order the percentage of married population to be 55%, i.e. close to its value in 2008 (Source: http://www.census.gov/population/socdemo/hh-fam/cps2008/tabA1-all.xls). We start with a gender wage gap $\tau = 78\%$ and we then examine the effect of decreasing it to 70% of men's wage, i.e. its value in the beginning of the 1990's (Source: http://www.iwpr.org/pdf/C350.pdf).[14] The lowest wage is normalized to 10, and it is assumed that wages are uniformly distributed between 10 and 100 with increments of 10.

Table 9

	Parameters	Values
Preferences	μ	0.5
	β	0.96
Public good parameter	γ	1/1.7
Household production technology	A	20
	ρ	0.19
	θ	0.2
	q	$2 \rightarrow 5$
Wages	w	$[10, 20, ..., 100]$
	τ	$0.78 \rightarrow 0.70$
Dissolution	π^m	0.30
	π^c	0.50
	ϕ	3.5

In the literature improvements of household production technology have been modeled as a reduction in the price of home appliances (e.g. Greenwood et al., 2005). We set $\rho = 0.19$ and $\theta = 0.2$, values estimated by McGrattan, Rogerson and Wright (1997). Regarding the change of the price of home appliances, the available data for

[14] In the model the gender wage gap is captured by the parameter τ, which expresses women's wage as percentage of men's wage. Hence, the lower τ, the wider the gender wage gap.

the US cover only the period between 1998-2008, during which the decline was 32% (US Bureau of Labor Statistics). We assume a moderate decline of similar magnitude for the years between 1990-1998 and we set the price in 1990 equal to 5, i.e. a 60% increase with respect to the price in 2008, which was 2.

1.4.1 The effect of the gender wage gap

First we examine the effects of the narrowing of the gender wage gap on women's market labor supply and on all agents' marital decisions. Recall that the agents live only for 2 periods. Therefore, in the last (2nd) period there is no difference between marriage and cohabitation as dissolution is not possible any more. This is why we will focus only on the 1st period.

The effect of the gender wage gap on agent's marital status is shown in Figure 4. When gender gap in pay is narrow, more agents choose to stay single or cohabit. As a result, the number of cohabiting agents as a percentage of all matched agents goes up, reducing the percentage of married population.

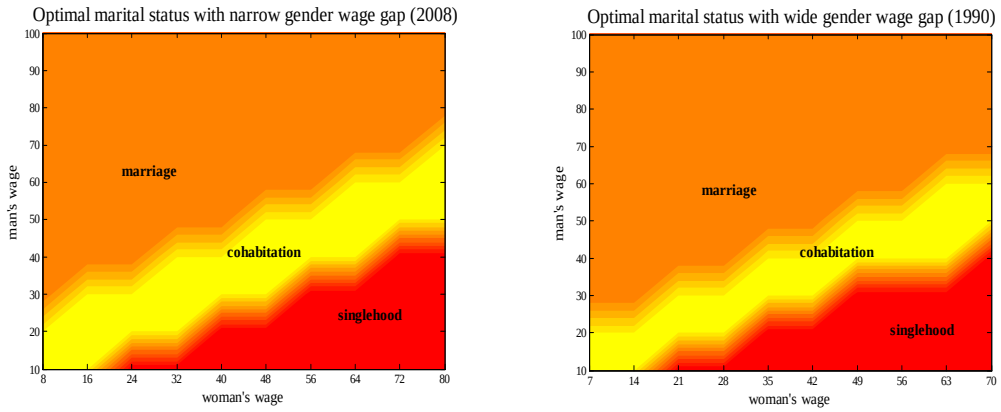

Figure 4

This effect is driven by changes in the market labor supply of the females. The narrowing of the gender wage gap makes women work more in the market, improving their outside option (singlehood). It is then more costly for a man to satisfy the woman's participation constraint and convince her to match with him. Moreover, the returns to specialization decrease, weakening the incentives to get married. Marriage implies higher cost and lower probability of dissolution than cohabitation. In the absence of substantial returns to specialization, cohabitation is favored against marriage.

Table 10

Female market labor supply by marital status
with narrow gender wage gap (2008)

man's wage \ woman's wage										
	0	0	0	0	0	0	0	0.07	0.14	0.20
	0	0	0	0	0	0	0.05	0.13	0.19	0.25
	0	0	0	0	0	0.02	0.11	0.19	0.24	0.29
	0	0	0	0	0	0.09	0.18	0.24	0.29	0.33
	0	0	0	0	0.07	0.17	0.25	0.30	0.35	0.38
	0	0	0	0.03	0.16	0.25	0.31	0.36	0.40	0.42
	0	0	0	0.15	0.26	0.33	0.38	0.42	0.65	0.65
	0	0	0.14	0.27	0.35	0.40	0.64	0.64	0.65	0.65
	0	0.12	0.30	0.39	0.63	0.64	0.64	0.64	0.65	0.65
	0.09	0.37	0.62	0.63	0.63	0.64	0.64	0.64	0.65	0.65

Female market labor supply by marital status
with wide gender wage gap (1990)

man's wage \ woman's wage										
	0	0	0	0	0	0	0	0	0.08	0.14
	0	0	0	0	0	0	0	0.07	0.14	0.19
	0	0	0	0	0	0	0.05	0.13	0.19	0.24
	0	0	0	0	0	0.03	0.12	0.19	0.25	0.29
	0	0	0	0	0	0.11	0.20	0.26	0.31	0.34
	0	0	0	0	0.10	0.20	0.27	0.32	0.36	0.39
	0	0	0	0	0.21	0.29	0.34	0.39	0.42	0.65
	0	0	0.08	0.22	0.31	0.37	0.64	0.64	0.64	0.65
	0	0.06	0.26	0.36	0.63	0.63	0.64	0.64	0.64	0.65
	0.02	0.33	0.62	0.63	0.63	0.63	0.64	0.64	0.64	0.65

Table 10 depicts the effect of the gender wage gap on female market labor supply. In the benchmark economy (left panel) the model predicts that 64% of women will participate in the market. This value is in accordance with recent statistics (US Bureau of Labor Statistics). First, the labor supply of single women remains fairly constant,[15] i.e. it is almost unaffected by the narrowing of the gender wage gap.[16] By contrast, the labor supply of all married and cohabiting women increases substantially after the narrowing of the gender wage gap. In the intensive margin, single women work more than both married and cohabiting women. Furthermore, a cohabiting woman will work more hours in the market than a married woman at the same wage rate.

A more interesting implication of the model has to do with the extensive margin of female labor force participation. There are many married women who are fully specialized in home production, while almost all cohabiting women do work in the market. Moreover, cohabiting couples are composed by partners with similar wages. Assortative matching is more prevalent in cohabitation than marriage. This is in accordance with the study of Brines and Joyner (1999) who show that economic equality is a key element of a long term cohabiting relationship and specialization for marriage.

1.4.2 The effect of the price of home appliances

We examine the effect of improvements in the household production technology through a decrease in the price of home appliances. The results are shown in Figure

[15] The model predicts that single women devote around 65% of their time to market labor. This number is reasonable, given the model's assumption that there is no leisure.

[16] This is in accordance with the data, see Jones et al (2003)

5. When home appliances are cheaper all men and women are better off because they can substitute house work with durables. However, some couples who would get married when home appliances were expensive, prefer to cohabit after the decline in prices. For these couples the benefits of marriage (specialization and returns to scale) are not enough so as to compensate the man for the cost of a possible divorce. On the one hand cohabitation can be dissolved without any cost. On the other hand cohabitation has a higher probability of dissolution. However, a possible dissolution can be accommodated more easily after the decrease in price of home appliances. Hence, these couples decide to cohabit instead of getting married.

There are also singles who decide to cohabit after the decline in price of home appliances in order to benefit from the increasing returns to scale in the household good. All in all, the rate of cohabitation increases and the percentage of unmarried population (cohabiting and singles) goes up.

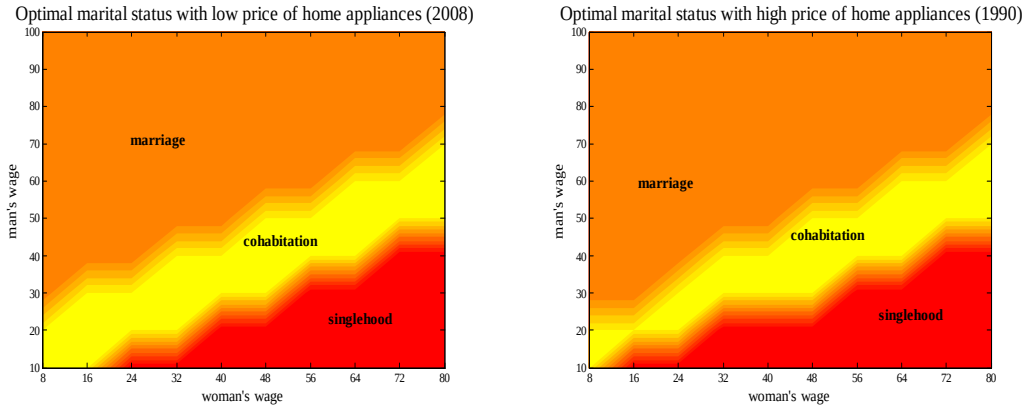

Figure 5

Similarly to the narrowing of the gender wage gap, the decrease in the price of home appliances also leads to an increase in female market labor supply (Table 11). Cheaper home appliances act as an "engine of liberation" for women allowing them to spend more time in the labor market (See Greenwood et al, 2005). The increase in female market hours is larger for married and cohabiting women than for single women.

Table 11

Female market labor supply by marital status with low price of home appliances (2008)

man's wage \ woman's wage										
	0	0	0	0	0	0	0	0.07	0.14	0.20
	0	0	0	0	0	0	0.05	0.13	0.19	0.25
	0	0	0	0	0	0.02	0.11	0.19	0.24	0.29
	0	0	0	0	0	0.09	0.18	0.24	0.29	0.33
	0	0	0	0	0.07	0.17	0.25	0.30	0.35	0.38
	0	0	0	0.03	0.16	0.25	0.31	0.36	0.40	0.42
	0	0	0	0.15	0.26	0.33	0.38	0.42	0.65	0.65
	0	0	0.14	0.27	0.35	0.40	0.64	0.64	0.65	0.65
	0	0.12	0.30	0.39	0.63	0.64	0.64	0.64	0.65	0.65
	0.09	0.37	0.62	0.63	0.63	0.64	0.64	0.64	0.65	0.65

Female market labor supply by marital status with high price of home appliances (1990)

man's wage \ woman's wage										
	0	0	0	0	0	0	0	0.02	0.09	0.15
	0	0	0	0	0	0	0	0.08	0.15	0.20
	0	0	0	0	0	0	0.06	0.14	0.20	0.25
	0	0	0	0	0	0.04	0.13	0.20	0.25	0.29
	0	0	0	0	0.02	0.13	0.20	0.26	0.31	0.34
	0	0	0	0	0.12	0.21	0.27	0.32	0.36	0.39
	0	0	0	0.11	0.22	0.29	0.34	0.38	0.63	0.63
	0	0	0.09	0.23	0.32	0.37	0.62	0.62	0.63	0.63
	0	0.08	0.26	0.61	0.61	0.62	0.62	0.62	0.63	0.63
	0.05	0.60	0.60	0.61	0.61	0.62	0.62	0.62	0.63	0.63

The numerical exercise shows that the narrowing in the gender wage gap leads to an indirect increase in the cohabitation rate by decreasing the number of married couples. The decrease in the price of home appliances instead leads to a direct increase in the cohabitation rate by increasing the absolute number of cohabiting couples. These effects are driven by changes in female labor market participation and hours of work.

1.5 Conclusions

This paper examines the rising forms of quasi marriages from an economic perspective. It presents some cross-country evidence on the evolvement of cohabitation and it is an attempt of getting a more general understanding of marital behavior in the last decade. Our conjecture is that more flexible types of family are associated with the improvement in the household production technology and the narrowing of the gender wage gap. These changes enabled women to work more in the market and be financially less dependent from their partners. Likewise, these changes reduced men's need to have a housewife for the household chores. In the data the price of home appliances as a proxy of household production technology has a strong effect on cohabitation confirming the general view that household production technology is a determinant of marital behavior. The gender wage gap also plays a role.

An interesting implication of the model is that women in cohabiting units do not specialize fully at home in contrast to the married ones. This is a result of the relative instability of cohabitation as a marital institution through its ease of dissolution. Moreover, a married woman, who does work in the market, works less hours than a cohabiting woman at the same wage rate.

1.6 Appendix

1.6.1 Data sources

Table A1. Data on cohabitation

Country	Source
Austria	Statistik Austria,www.statistik.at
Belgium[17]	SPF Economie - Direction generale Statistique et Information economique selon le Registre National, www.statbel.fgov.be
Denmark	Statistics Denmark, www.dst.dk
Finland	Statistics Finland, www.stat.fi
France	INED, www.ined.fr
Germany	Statistisches Bundesamt Deutschland, www.destatis.de
Hungary	UNECE, www.unece.org
Ireland	UNECE, www.unece.org
Italy	UNECE, www.unece.org
Netherlands	Statistics Netherlands, www.cbs.nl
Norway	Statistics Norway, www.ssb.no
Spain	UNECE, www.unece.org
Sweden	UNECE, www.unece.org
UK	own calculations from the General Household Survey, www.esds.ac.uk
US	U.S. Census Bureau, www.census.gov

Table A2. Data on price of home appliances and CPI

Country	Source
US	Bureau of Labor Statistics, www.bls.gov/data
Other countries	Eurostat, http//epp.eurostat.ec.europa.eu

[17] The data for Belgium do not refer solely to cohabiting couples but also include pairs of cohabiting persons of the same or different sex, eg. two siblings or two friends.

Table A3. Data on price of GDP growth and urban population

Country	Source
All countries	World Bank (WDI), www.worldbank.org

Table A4. Data on gender wage gap

Country	Source
Austria	UNECE, www.unece.org
Belgium	Eurostat, http//epp.eurostat.ec.europa.eu
Denmark	OECD, www.oecd.org
Finland	OECD, www.oecd.org and UNECE, www.unece.org
France	Eurostat, http//epp.eurostat.ec.europa.eu and OECD
Germany	Eurostat, http//epp.eurostat.ec.europa.eu
Hungary	UNECE, www.unece.org
Ireland	Eurostat, http//epp.eurostat.ec.europa.eu
Italy	-
Netherlands	Eurostat, http//epp.eurostat.ec.europa.eu
Norway	UNECE, www.unece.org
Spain	Eurostat, http//epp.eurostat.ec.europa.eu
Sweden	Eurostat, http//epp.eurostat.ec.europa.eu
UK	OECD, www.oecd.org
US	U.S. Census Bureau, www.census.gov

1.6.2 First order conditions

2nd period optimal marriage proposal. The optimal marriage proposal problem in the 2nd period is

$$\max_{c_f^m>0, 0\leq l_f^m<1, d^m>0} \mu \ln(w_m + w_f l_f^m - qd^m - c_f^m) + (1-\mu)\ln(\gamma A (d^m)^\theta (1-l_f^m)^{1-\theta})$$

subject to

$$\mu \ln(\mu w_f) + (1-\mu)\ln(A(\theta(1-\mu)\frac{w_f}{q})^\theta((1-\theta)(1-\mu))^{1-\theta}) \leq \mu \ln(c_f^m) + (1-\mu)\ln(\gamma A (d^m)^\theta (1-l_f^m)^{1-\theta}).$$

The first order conditions for interior solutions ($l_f > 0$) are given by (M1)-(M3). Derivating with respect to the woman's consumption good we get

$$\frac{\mu}{w_m + w_f l_f^m - qd^m - c_f^m} = \zeta \frac{\mu}{c_f^m},$$

which becomes

$$\frac{1}{w_m + w_f l_f^m - qd^m - c_f^m} = \zeta \frac{1}{c_f^m}. \tag{M1}$$

Derivating with respect to the woman's labor supply we get

$$\frac{\mu w_f}{w_m + w_f l_f^m - qd^m - c_f^m} - \frac{(1-\mu)(1-\theta)}{(1-l_f^m)} = \zeta \frac{(1-\mu)(1-\theta)}{(1-l_f^m)},$$

which can be written as

$$\frac{\mu w_f (1-l_f^m) - (1-\mu)(1-\theta)(w_m + w_f l_f^m - qd^m - c_f^m)}{(w_m + w_f l_f^m - qd^m - c_f^m)} = \zeta(1-\mu)(1-\theta). \tag{M2}$$

Lastly, derivating with respect to the amount of durables we get

$$\frac{\mu q}{w_m + w_f l_f^m - q d^m - c_f^m} - \frac{(1-\mu)\theta}{d^m} = \zeta \frac{(1-\mu)\theta}{d^m},$$

which can be written as

$$\frac{\mu q d^m - (1-\mu)\theta(w_m + w_f l_f^m - q d^m - c_f^m)}{(w_m + w_f l_f^m - q d^m - c_f^m)} = \zeta(1-\mu)\theta. \tag{M3}$$

1.6.3 Robustness

The married/cohabitating man does not work full time in the market. The model presented in Section 1.3 is based on the assumption that the man works full time in the market and the woman allocates her time between the house- and market work. We relax this assumption by assuming that the man devotes a fixed amount of time to housework denoted by $\overline{z}$. The optimal marital proposal in the 2nd period becomes

$$\max_{c_f^m > 0, 0 < l_f^m \leq 1, d^m > 0} \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m) \tag{24}$$

subject to

$$\begin{aligned} c_m^m + c_f^m &= w_m(1-\overline{z}) + w_f l_f^m - q d^m, && \text{(BC)} \\ h^m &= A(d^m)^\theta (1 - l_f^m + \overline{z})^{1-\theta}, && \text{(HPT)} \end{aligned}$$

and

$$U_f^s(w_f) \leq \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m). \tag{WPC}$$

The first order condition for the woman's consumption good is

$$\frac{\mu}{w_m(1-\overline{z}) + w_f l_f^m - q d^m - c_f^m} = \zeta \frac{\mu}{c_f^m},$$

which becomes

$$\frac{1}{w_m(1-\overline{z}) + w_f l_f^m - q d^m - c_f^m} = \zeta \frac{1}{c_f^m}. \tag{R1}$$

Derivating with respect to the woman's labor supply we get

$$\frac{\mu w_f}{w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m} - \frac{(1-\mu)(1-\theta)}{(1-l_f^m+\overline{z})} = \zeta \frac{(1-\mu)(1-\theta)}{(1-l_f^m+\overline{z})},$$

which can be written as

$$\frac{\mu w_f(1-l_f^m+\overline{z}) - (1-\mu)(1-\theta)(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)}{(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)} = \zeta(1-\mu)(1-\theta). \tag{R2}$$

Lastly, derivating with respect to the amount of durables we get

$$\frac{\mu q}{w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m} - \frac{(1-\mu)\theta}{d^m} = \zeta \frac{(1-\mu)\theta}{d^m},$$

which can be written as

$$\frac{\mu q d^m - (1-\mu)\theta(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)}{(w_m(1-\overline{z})+w_f l_f^m - qd^m - c_f^m)} = \zeta(1-\mu)\theta. \tag{R3}$$

The solution is

$$d^m = \frac{(1-\mu)\theta(w_f+w_m)}{q} + \overline{z}\frac{(1-\mu)\theta(w_f-w_m)}{q}, \tag{25}$$

$$l_f^m = (1+\overline{z})(\mu+(1-\mu)\theta) - (1-\overline{z})(1-\mu)(1-\theta)\frac{w_m}{w_f}. \tag{26}$$

We then perform the numerical example of Section 1.4 for $\overline{z} = 0.10$.

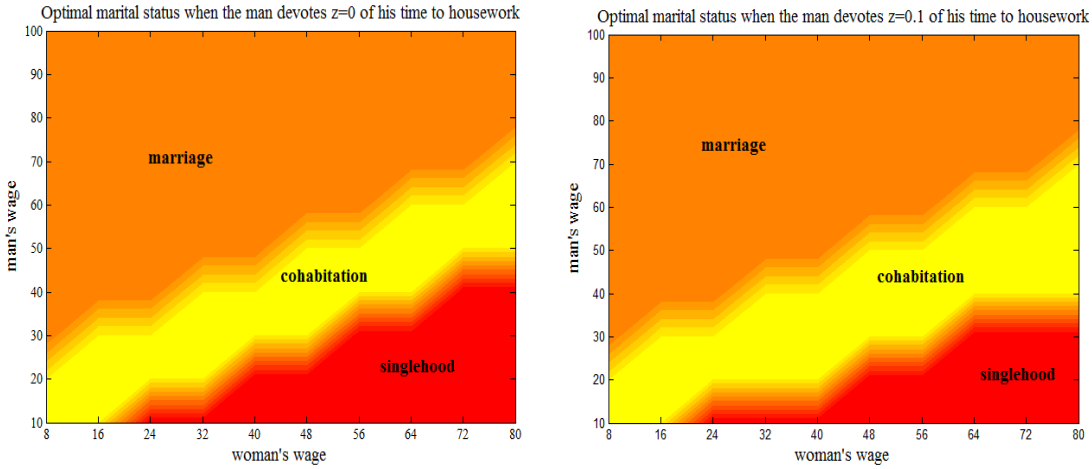

Figure 6

When we allow the man to devote 0.10% of his time to housework the results are similar to the ones we obtained when the man worked full time in the market. The number of cohabiting households has slightly increased while the number of singles has slightly decreased. This happens because a man with a relatively low salary can now convince a woman with a high salary to cohabit with him by offering his housework.

The woman makes the take-it or leave-it offer to the man. In Section 1.3 we assumed that the man is the one who proposes marriage or cohabitation to the woman upon meeting in the marriage market. We check if our results are driven by this assumption and we examine the case that the woman makes the offer. The problem of the optimal marriage proposal in the 2nd period becomes

$$\max_{c_m^m>0, 0<l_f^m\leq 1, d^m>0} \mu \ln(c_f^m) + (1-\mu)\ln(\gamma h^m) \tag{27}$$

subject to

$$\begin{aligned} c_m^m + c_f^m &= w_m + w_f l_f^m - q d^m, && \text{(BC)} \\ h^m &= A(d^m)^\theta (1-l_f^m)^{1-\theta}, && \text{(HPT)} \end{aligned}$$

and

$$U_m^s(w_m) \leq \mu \ln(c_m^m) + (1-\mu)\ln(\gamma h^m). \tag{MPC}$$

The woman is now trying to maximize her utility by choosing the hours she will

work in the market and the amount of consumption good and durable good she will offer to the man. We maintain the assumption that the man works full time in the market. The woman has to take into account the man's participation constraint in her decision i.e. she has to be able to convince him to cohabit/get married to her.

The first order conditions with respect to l_f^m and d^m are the same as in the case that the man makes the offer. We obtain c_m^m from the man's participation constraint which will bind (following the same reasoning as in Section 1.3) and lastly we get c_f^m from the budget constraint. The woman will compare her utility in singlehood, cohabitation, and marriage and decide whether making or not a proposal to the man as well as the kind of the proposal (marriage or cohabitation).

The numerical example yields exactly the same results. The only difference lies on the fact that the utility of the woman is higher in marriage or cohabitation than in singlehood, while the utility of the man is always the same as his participation constraint is binding. This mitigates the optimal marital status that is obtained when the man makes the take-it or leave-it offer.

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Chapter 2. Peer Effects in Young Adults' Marital Decisions

2.1 Introduction

Friends are an important part of individuals' life and constitute, together with the family, the social circle in which individuals develop. Friends often spend time together participating in the same activities (sports, school, etc), discussing about different topics and exchanging ideas. It is not then unrealistic to think that friends might affect each other's behavior through their opinions or through imitation. In fact, there is a large literature on peer group effects showing that friends actually affect, among others, the individual performance at school (Hoxby, 2000; Sacerdote, 2001; Calvó-Armengol, Patacchini and Zenou, 2009; Boucher, Bramoullé, Djebbari, and Fortin, 2010), obesity (Cohen-Cole and Fletcher, 2008), smoking habits (Gaviria and Rafael, 2001; Powell, Tauras and Ross, 2005; Fletcher, 2010: Card and Giuliano, 2011), and/or alcohol consumption (Clark and Lohéac, 2007; Fletscher, 2011), fertility (Kuziemko, 2006; Ciliberto, Miller, Nielsen, and Simonsen, 2010; Hensvik and Nillson, 2010), productivity (Falk and Ichino, 2006), the probability of finding a job (Topa, 2001; Calvó-Armengol and Jackson, 2004; Cappellari and Tatsiramos, 2010, Cingano and Rosolia, 2012), and the probability of engaging in criminal activities (Glaeser, Sacerdote and Scheinkman, 1996; Patacchini and Zenou, 2011).[1]

But what about marital decisions? Getting married or cohabiting is a decision that many young couples face. In order to make a decision, a potential couple might discuss with their parents, sibling or friends. If most friends of an individual are married, she may also want to get married in order, for example, to avoid being stigmatized by her friends. Likewise, if many of her friends are cohabiting she may also decide to do so.

[1] See Blume, Brock, Durlauf, and Ioannides (2011) for an excellent review of papers on social interactions.

What the couple considers as a norm depends not only on the society as a whole (e.g. religion or tradition) but also on one's circle of close friends.

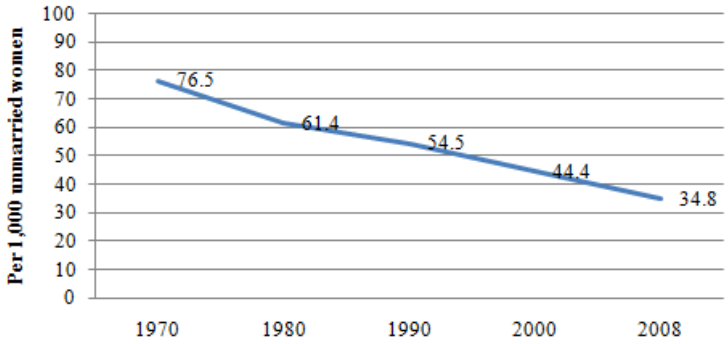
In this paper, we investigate whether the marital decisions of one's friends have any effect on one's own marital decisions. We use direct information on individuals' high school friends from the National Longitudinal Study of Adolescent Health (Add Health). We construct a balanced panel using the calendar of all past and current relationships of the respondents, which allows us to recover the marital status and other characteristics of each individual and of her friends at any given year. We motivate our empirical exercise with a model of conformism and our results show that conformism might be the key mechanism behind the observed peer group effects. We find that an increase of one standard deviation in the percentage of friends that are married will increase the individual probability of getting married by 2.2 percentage points. The effect is statistically significant for females but not for males.

The biggest obstacle in identifying peer effects in marital decisions of the individuals has been data availability. In order to investigate the extent of peer group effects, Billari et al. (2007) use simulated data to show that social influence is the key driving force of the process of first marriage. Drewianka (1999 and 2003) uses data from PUMS and shows that a 10 percentage point increase in the fraction of persons aged 16-44 in a geographical area who are single leads to a decrease in individual's propensity to marry of an order of 1.5-2.0 percentage points. Moreover, he finds evidence that social effects operate through markets (search externality) and not directly through stigma or role modelling. Not only initiation but also termination of marriage might be influenced by peers. McDermott, Folwer, and Christakis (2009) show that divorce can spread between friends, siblings and coworkers.

Let us first discuss briefly the rapid changes in marital behavior that took place during the last decades. As Figure 1 shows, the marriage rate in the US has fallen

drastically. Similar changes have been observed also in other developed countries.

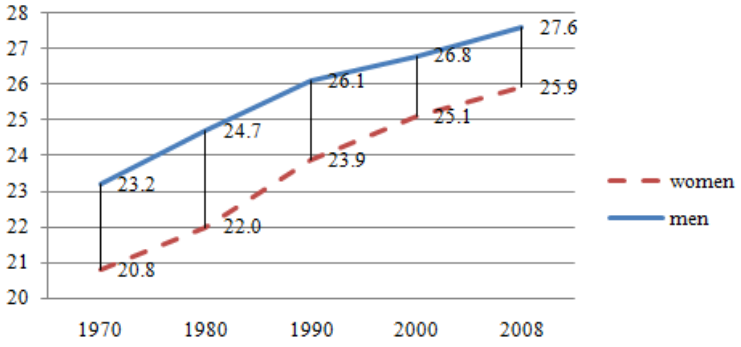
Figure 1. Marriage Rate in the U.S.



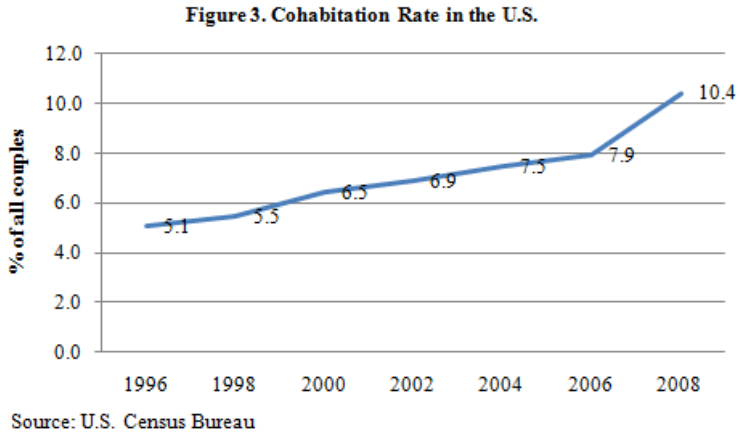
Source: National Center for Family & Marriage Research

Many studies have tried to identify the factors behind the drop in the marriage rate (declining gender gap, Becker 1981; contraceptive pill, Goldin & Katz, 2002; household production technology, Greenwood & Guner, 2009 to name a few). These forces are likely to be amplified if there exist peer group effects that create a social multiplier. As a result, the effect of family-friendly policies, tax reforms, divorce laws, etc. will be augmented. Part of this drop is also due to the increase in the median age at first marriage (Figure 2). Individuals nowadays get married at an older age than what they used to do in the past. Hence, also the timing of marriage may be contagious in the sense that individuals decide to get married after observing that one of their peers got married.

Figure 2. Estimated Median Age at First Marriage in the U.S.



Source: U.S. Census Bureau



Cohabitation is a more recent phenomenon that is becoming more and more popular especially among young couples (Bumpass & Lu, 2000). This upward trend (Figure 3), that is also present in western European countries, has been attributed to economic factors like the gender wage gap and the household production technology (Adamopoulou, 2010), female labor force participation and tertiary education (Kalmjin, 2007) or tax reforms (Leturcq, 2009). In addition to these factors, there might be an imitation effect (peer effect) at work that self-enforced the increase of cohabitation. Our aim is to identify peer effects in the decision to get married or cohabit as well as in the timing of these actions. In the next section we use a model of conformism in order to study a possible way friends can influence an individual's marital decisions. The model motivates the empirical analysis that follows.

2.2 Model

The model is based on Patacchini and Zenou (2011), who study juvenile delinquency using a model of conformism. The key element of the model is the notion of conformism, i.e., quoting the authors description, *'the idea that the easiest and hence best life is attained by doing one's very best to blend in with one's surroundings and to do nothing eccentric or out of the ordinary in any way'.* Conformism might also be important for young adults when they decide whether to get married or cohabit. We first define the network structure of agents' friendships, and we then describe the

preferences of the agents.

There is a finite number of agents $N = \{1, ..., n\}$. Let g denote a particular network. We use the n-square adjacency matrix G of a network g to keep track of the direct connections in this network (see Jackson, 2008). Two agents i and j are directly connected in the network g if and only if $g_{ij} = 1$. We set $g_{ii} = 0$, i.e. the agent cannot be a friend of herself. The set of direct connections of agent i is $N_i(g) = \{j \neq i \mid g_{ij} = 1\}$, which is of size $g_i = \sum_{j=1}^{n} g_{ij}$. In general $N_i(g) \neq N_j(g)$, unless the network is complete and everybody is a friend of everybody.

Each agent decides whether to stay single and just date with a partner, cohabit or get married. We assume, therefore, that there are many different degrees of formality that the relationship can take ranging from very informal (dating) to very formal (getting married). We denote the formality of the relationship by f_i. We then define the average formality of the relationships of i's friends as $\overline{f_i}(g) = \frac{1}{g_i} \sum_{j=1}^{n} g_{ij} f_j$

Each agent selects a degree of formality $f_i \geq 0$ for her relationship and receives a payoff $u(f_i, \overline{f_i})$ given by the utility function

$$u_i(f_i, \overline{f_i}) = a + b_i f_i - \pi f_i \phi - c f_i^2 - d(f_i - \overline{f_i})^2,$$

with $a, c, d > 0$, and $b_i > 0$, $\forall i$.

There is a benefit from formalizing the relationship, which is given by the term $a + b_i f_i$. The agents are ex ante heterogeneous with respect to b_i. The parameter b_i is assumed to be deterministic and observable by all agents in the network and it represents observable characteristics of individual i (e.g., gender, race, age, education, religion etc.) and to the observable average characteristics of individual i's friends (contextual effects). More specifically,

$$b_i(x) = \sum_{m=1}^{M} \beta_m x_i^m + \frac{1}{g_i} \sum_{m=1}^{M} \sum_{j=1}^{n} \theta_m g_{ij} x_j^m,$$

where x_i^m are observable characteristics of individual i, the term $\frac{1}{g_i} \sum_{m=1}^{M} \sum_{j=1}^{n} g_{ij} x_j^m$ captures the contextual effects, and β_m, θ_m are parameters.

There is also a cost of formalizing the relationship, which is given by the term

$-\pi f_i \phi - c f_i^2$. The parameter π is the probability that the relationship ends and the parameter ϕ is the cost of ending the relationship. The cost of ending a relationship increases as the formality increases, i.e. it is more costly to separate if one is married than if one is cohabiting. Likewise, it is more costly to separate if one is cohabiting with a partner than if one is just dating this partner. The term $-cf_i^2$ is needed so as the cost function to be convex. Transiting from cohabitation to marriage is a more complicated procedure than transiting from dating to cohabitation.

The last term in the utility function, $-d(f_i - \overline{f_i})^2$, reflects the influence of friends' behavior on own action. Each agent tries to minimize the distance between herself and her group of friends. The agent loses utility from failing to conform to others. Parameter d represents the taste for conformity.

In this framework there exists a unique Nash equilibrium (Patacchini and Zenou, 2011) where each individual chooses the optimal formality of relationship f_i^*

$$f_i^* = \frac{d}{c+d}\overline{f_i} + \frac{b_i}{2(c+d)} - \frac{\pi\phi}{2(c+d)},$$

which is increasing in $\overline{f_i}$. In other words, the more formal the relationships of one's friends are, the more the individual will formalize her own relationship.

In the next section we test this result empirically and we try to figure out whether the percentage of individuals' married and cohabiting friends has any effect on individuals' decisions to enter into marriage or cohabitation. We also discuss other possible mechanisms that may drive the peer effect in marital decisions and provide evidence that support conformism as the main mechanism.

2.3 Data

Add Health is a longitudinal study of a nationally representative sample of adolescents in grades 7-12 in the United States during the 1994-95 school year.[2] In Wave I

[2]This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

the study started with an in-school questionnaire that was administered to more than 90,000 students from 80 high schools and 52 middle schools. A subsample of them (around 20,000) were also asked to complete in-home interviews and were followed in subsequent waves (II, III, and IV). The last wave was conducted in 2008, when the sample was aged 24-32. Adolescents had to answer questions about their family background, school performance, area of residence, tobacco and alcohol consumption, criminal activities as well as about sexual behavior (contraception, pregnancy, HIV and STD). In Wave I adolescents' mothers were also interviewed, and as a result, we can obtain information on their characteristics as well. However, mothers were not interviewed in the subsequent waves so it is not possible to update this information.

Wave III in-home interviews took place in years 2001 and 2002 and were completed by around 15,000 respondents aged 18-28. In Wave III the respondents had to list all their current and previous sexual relationships (82% non missing responses) providing detailed information on the starting and ending date, whether they cohabited and how long, when they got married etc. Using this information we create a balanced panel for the years 1995-2002. For example, if a respondent listed a relationship with a partner for the years 2000-2002 with whom she started cohabiting in 2001 and she got married in 2002, we will consider her single for the year 2000, cohabiting in 2001, and married in 2002. If the respondent had more than one relationship in a given year we keep the one with the longest overall duration. The procedure is similar to the one in Xie et al. (2003), and Raley et al. (2007) that analyze the determinants of marital transitions.

In Wave I, data collectors assigned an identification number to each student and provided a list of all students to the respondents in order to identify their friends. Respondents were allowed to list up to five male friends and up to five female friends. We treat two students as friends if at least one of the two has identified the other as his/her friend. On average, each respondent has nominated 5.9 friends. As long as their nominated friends were also interviewed (i.e. they were part of the random subsample who completed the in-home survey), one can construct for each respondent a set of friends with detailed Add Health information. Given that the data represent a subsample of students within schools, not all nominated friends are interviewed and as a result, the measures of friends' characteristics will be imperfect. However, since the sampling scheme was random within grades, and most friends were in the same grade, the measures should be on average correct. On average, each respondent has

2.2 nominated friends who were also part of the survey.

In Wave III, when the respondents were between ages 18 and 28, those who were in grades 7 and 8 in Wave I (two youngest grades), were interviewed about their current and former friends. In particular, data collectors presented each respondent with a list of 10 names and asked if any of them is currently or used to be their friend. For former friends, they also asked to state when the friendship ended and why. This list was created, based on an algorithm, using information from club membership and other school activities. As a result, it is possible for some respondents to identify current as well as former friends from this list. Furthermore, for former friends it is possible to know the year that the friendship has ended. By matching the identification numbers of friends to respondents' identification numbers we obtain information on the characteristics of nominated friends. In this way we know at any given year the marital status of the respondent and the marital status of his/her friends.

Our final sample using Wave I friendship nominations consists of 2,644 respondents with non missing relationship history that have at least one friend with non missing relationship history as well. Given that not all nominated friends are interviewed, restricting the sample to respondents who provided usable information for at least one nominated friend results in this reduction of the sample. The descriptive statistics of the individuals in our final sample are similar to the ones of all the individuals interviewed in wave III, ensuring that the final sample is still representative (see Table A1).

2.4 Empirical Strategy

Individual behavior may move conjointly with average peer group behavior for three different reasons. i) Endogenous effects; the behavior of the individual is causally influenced by the behavior of the group. This is the peer effect that we are trying to estimate. ii) Contextual effects; the behavior of the individual is influenced by the characteristics of the group. For example an individual might decide to get married because her friends are very religious independently from whether the friends are married or not. iii) Correlated effects; the individual and the group behave in the same way due to similar environments that are unobserved or due to endogenous friendship formation/sorting. This arises either from the fact that both the individual and her

friends are subject to common unobserved shocks or because the individual selects friends who are similar to her.

Manski (1993) shows that identifying the endogenous and the contextual effects separately in a reduced form linear model is not possible. This is called the reflection problem and it is due to the fact that group behavior is by definition the aggregation of individual behavior. Solutions that have been proposed in order to solve the reflection problem consist of using instrumental variables techniques, or using panel data (see Bramoullé, Djebbari, and Fortin, 2009; Boucher et al., 2010). Instruments are used in order to generate variation in peer behavior that is independent from individual behavior. Examples of identification strategies with instrumental variables include Ciliberto et al. (2010) that use the fertility of the siblings of one's colleagues as an instrument for the fertility of one's colleagues, and Fletscher (2011) that uses the alcohol consumption of the parents of one's classmates as an instrument for the alcohol consumption of one's classmates. The basic idea is that siblings or parents of peers affect the behavior of the peers but have no independent effect on the respondent's behavior. De Giorgi, Pellizzari, and Redaelli (2010), and Pattachini and Zenou (2011) exploit the information about the whole network of friendships and instrument the behavior of the respondent's friends with the characteristics of friends of friends who are not directly linked with the respondent. With panel data one can focus on changes in the behavior over time in order to deal with the reflection problem. In this way, the reflection problem will disappear since the characteristics of the peers are already determined at the time that the change in individual behavior (transition into employment, having a child, getting married etc.) takes place. Clark and Lohéac (2007) use panel data from Waves I and II of AddHealth to examine risky behavior (the consumption of tobacco, alcohol and marijuana). Kuziemko (2006) uses panel data in order to show that fertility is contagious among siblings. Cappellari and Tatsiramos (2011) use panel data to show that employed friends increase the probability of transition into employment. In an alternative identification strategy they consider the effect of the respondent on friends' transitions and instrument the respondent's employment status with the health status.

We instrument the percentage of married and cohabiting peers using the contextual variables. We thus assume that there is no direct effect of friends' characteristics on respondents' decisions and use friends' characteristics as instruments for their marital

behavior. This procedure is common in the literature (e.g. Gaviria and Raphael, 2001; Powell et al., 2005).

What about correlated effects? One might worry that people make new friends as they get married, often through their spouse. Hence, it is normal for married people to make new friends who are also married. In this case endogeneity would be a serious problem in identifying the peer effects. In the current analysis we consider friends since high school and we have information about friendship dynamics. This solves part of the endogenous friendship formation in later years. Moreover it is not very likely that adolescents selected friends in high school according to characteristics that determined their marital behavior afterwards.

We use a panel data fixed effects estimator in order to deal with the correlated effect. Assuming that any correlation between the behavior of the peers and individual unobserved traits is due to traits that do not vary over time a panel data fixed effect estimator can deal with the correlated effect. Other studies that use a fixed effect estimator are Kuziemko (2006) and Cappellari and Tatsiramos (2011). Further robustness/falsification tests using placebo peer groups in the spirit of Fletscher (2011), and Hensvik and Nillson (2010) show that the peer effect is not due to selection.

2.5 Regression analysis

The benchmark regression is

$$f_{it} = \overbrace{\xi^M \overline{f_{it}^M} + \xi^C \overline{f_{it}^C}}^{\text{endogenous effects}} + \underbrace{\sum_{m=1}^{M} \beta_m x_{it}^m}_{\substack{\text{individual characteristics} \\ \text{(gender, age, race, etc)}}} + \underbrace{\frac{1}{g_i} \sum_{m=1}^{M} \sum_{j=1}^{n} \theta_m g_{ij} x_{jt}^m}_{\substack{\text{average peer characteristics} \\ \text{(contextual effects)}}} + y_t + \varepsilon_{it}$$

where f_{it} is a binary variable that takes the value 1 if an individual gets married (i.e. the individual was not married at $t-1$ and gets married at t), and 0 otherwise, $\overline{f_{it}^M}$, $\overline{f_{it}^C}$ are the percentages of married and cohabiting peers, ξ^M and ξ^C are the coefficients of interest, i.e. the peer effect that we are trying to estimate, x_{it}^m are the individual characteristics of the respondents (m variables that include gender, age, education, race, religiosity, beauty, relationship duration, out of wedlock births, mother's educa-

tion, mother's age at first marriage, whether the mother was married in Wave I, and whether the mother has ever cohabited), $\frac{1}{g_i}\sum_{j=1}^{n} g_{ij}x_{jt}^{m}$ are the average individual and maternal characteristics of $i's$ n peers (contextual variables), i.e. the percentage of female peers, average education, percentage of African American peers, average religiosity, average beauty, average relationship duration, percentage of peers with out of wedlock births, average maternal education, average mother's age at first marriage, percentage of individuals whose mother was married in Wave I, and percentage of individuals whose mother has ever cohabited.[3] y_t are year dummies.

2.5.1 Wave I nominations

We first examine the determinants of the transition into first marriage using the friends nominations from Wave I. Here, we assume that friendships have lasted after high school up to Wave III (i.e. for 7 years). This assumption will be relaxed afterwards using the updated information from Wave III (only for the subsample that this information is available). Table 1 shows the descriptive statistics for a total of 2,644 respondents with non missing own and peer relationship information. Around 67% of the respondents have one friend, 14% have 2 friends, 6% have 3 friends, 5% have 4 friends, 3% have 5 friends and less than 3% have 6-8 friends.[4]

We start our analysis with a linear probability model (Table 2, column 1). The dependent variable takes the value 1 if someone who was not married in the previous year gets married in the current year, and the value 0 otherwise. The variables of interest are the ratio of each individual's friends that are cohabiting and the ratio of friends that are married. We include as regressors the characteristics of the individuals, such as age, gender, race, education, religiosity, and a measure of beauty (the interviewer had to assess the physical attractiveness of the respondent). All variables are explained in the appendix. We also include whether a respondent had an out-of-wedlock birth in the past as this might affect the probability of getting married. We account for maternal characteristics, such as mother's marital status at Wave I,

[3] We do not include the average age of the peers, due to the very high correlation with the age of the respondent (in most cases the respondent and her friends have the same age).

[4] In the in-school survey adolescents had nominated on average 6 friends. We consider friends that have completed the in-home interview of Wave III in order to have information about their relationship history. Given that only 15,000 out of 90,000 students participated in Wave III the number of peers is reduced substantially.

mother's education, mother's age at first marriage and whether the mother has ever cohabited. We include the duration of the relationship which also acts as a control for being in a relationship (when someone is not in a relationship, relationship duration will be zero). All these are variables commonly used in the literature when studying the determinants of marital behavior (see Raley et al., 2007). Finally, we include year dummies in all specifications. We use the appropriate weights and robust standard errors clustered at the school level. In this specification we also include contextual variables, i.e. the average individual characteristics of the peers. The percentage of married peers has a statistically significant effect on the transition into marriage. If all the peers of a young adult get married, the individual probability of getting married is 2.3 percentage points higher than in the case that none of his/her peers is married. The percentage of cohabiting peers does not seem to matter.

We then perform 2SLS in order to improve the identification (Table 2, column 2, see Tables A3 and A4 for the 1st stage regressions). Following the literature (Gaviria and Raphael, 2001; Powell et al., 2005) we assume that the contextual variables do not have any effect on individual behavior, i.e. $\theta_m = 0$ (indeed their effect was statistically insignificant in the OLS) and we exclude them from the regression. Instead, we use these contextual variables as an instrument for the percentage of married and cohabiting peers.[5] The F statistic of the excluded instruments in the 1st stage is larger than 10 (18.43 for the percentage of married peers and 23.25 for the percentage of cohabiting peers) indicating that the instruments are not weak. The Hansen J statistic does not reject the hypothesis of the validity of the instruments. The effect of married peers remains statistically significant and its magnitude increases. In particular, if all the peers of a young adult get married, the individual probability of getting married is 6.2 percentage points higher than in the case that none of his/her peers is married. This effect is not small, given that the individuals in our sample are young (22.4 years old) and only 16.9% of them got married. In our sample the mean of the variable of interest (% of friends that are married) is 0.18 with a standard deviation of 0.35. According to our estimates an increase of one standard deviation in the percentage of friends that are married will increase the individual probability of getting married by 2.2 percentage points. This increase in peer behavior represents an increase in indi-

[5] Alternatively we tried to use the characteristics of friends of friends who are not directly connected to the respondents but they turned out to be very weak instruments.

vidual behavior of about 5.9 percent of its standard deviation (which is 0.37). This effect is not negligible.

Alternatively, we perform a panel data fixed effect estimation that also can deal with the identification issues (Table 3, column 1). In this specification we include only time varying variables (age, education, out of wedlock births and the duration of the relationship). We also control for the average education and relationship duration of the peers. We cannot include parental characteristics because we have information only for Wave I (and hence no time variation). The peer effect remains significant but decreases in magnitude.

Lastly, instead of using friends, we focus on the effect of friends of friends who are not directly connected with the respondents (Table 3, column 2). The percentage of married friends of friends has a similar effect although not statistically significant. Hence, there is no clear evidence of spill-over effects between individuals that are only indirectly connected with each other.

We also perform the analysis for girls and boys separately to see whether there are any gender differences with respect to the magnitude, significance or the direction of the effect. The peer effect on girls is positive, and statistically significant (Table 4, columns 1 and 2), while the peer effect on boys (Table 4, columns 3 and 4) is not statistically significant. This result might reflect a stigma towards unmarried females that is stronger than towards males. On the other hand, this gender difference might just reflect the fact that girls have more female friends than boys, and females get married at an earlier age than males. More specifically in our sample almost 21% of girls got married by 2002 while this percentage falls to 12% for boys. Around 56% of girls have only female friends and 45% of boys have only male friends.

Same gender friends

One might worry that respondents nominate as friends individuals of different gender with whom they have a sexual relationship.[6] In this case, the peer effect would be spurious. Suppose that a male respondent nominates as a friend a girl with whom he has a relationship and eventually he gets married. Hence, the percentage of married peers increases and at the same time he transits into marriage. A situation like this

[6] The survey had a separate section about "special" friends and therefore the respondents were not supposed to include them among the nominated friends.

would be mistakenly considered as peer effect although in reality the respondent and his peer had married each other. For this reason we conduct the same analysis using same-gender friends only. The results remain almost unchanged (Table 5) indicating that there should be no concern about marriages among peers.

Differential peer effect

But who are the ones who are influenced by their peers? Are they all the individuals or only some particular groups? In order to answer this question we analyze separately different groups of individuals with respect to religiosity and race. Marital behavior differs substantially between religious and non religious individuals, white and African Americans, hence the peer effect might also differ. Indeed, when we repeat the analysis for different groups we find that the peer effect vanishes for the non-religious ones (defined as those who have never attended religious services in the past 12 months), and it becomes stronger for the religious ones (Table 6, columns 1 and 2). Moreover, the peer effect is present only for less educated individuals and not for those that they continue with their studies after highschool (Table 6, columns 3 and 4). More religious and less educated individuals are the ones that get married early, and therefore the effect comes from these particular groups of people.

Cohabitation

Next, we conduct the same analysis for the transition into cohabitation (Table 7). In this case the dependent variable takes the value 1 if an individual was not cohabiting at $t-1$ and starts cohabiting at t, and is zero otherwise. Our variables of interest are again the percentages of married and cohabiting peers. On the one hand, we find no statistically significant effect of the percentage of cohabiting peers. This means that if an individual has many cohabiting peers this will not increase her probability of cohabiting. On the other hand, there is a negative effect of the percentage of married peers on the decision to cohabit. We interpret this as evidence in favor of conformism with respect to marriage. If all the peers of a young adult get married, the individual probability of entering cohabitation is 5.5 percentage points lower than in the case that none of his/her peers is married. Hence, having married peers acts as a deterrent to cohabitation.

Timing of the transition

As we discussed in the introduction, the age of first marriage has increased during the last decades. Hence, it might be the case that the timing of marriages is contagious. To study this we check whether the transition into marriage in a given year is affected from any peer who got married in the previous year or from any peer who started cohabiting in the previous year. The results in Table 8 suggest that the peer effect in the timing of marriage is significant and similar in magnitude as the peer effect in the decision to get married. Moreover, also in the case that a peer started cohabiting in the previous year the respondent's probability of getting married this year goes up (but less than if the peer got married). There is no peer effect in the timing of cohabitation (Table 9). There is evidence of a negative effect on the timing of cohabitation if some peer got married in the last year, supporting the conformistic behavior that is entailed with marriage.

Mechanism

From the analysis so far, there is evidence of a conformistic behavior with respect to marriage. However, there might be alternative underlying mechanisms, such as leisure complementarities or search externalities. A mechanism of leisure complementarities will drive individuals into marriage in order to share common interests with their married peers. The lifestyle of married people is different from the one of singles. As a result, a single individual with many married peers might decide to get married in order to be able to spend time with them doing similar activities. We use the geographical proximity of friends in order to see whether this mechanism is at work. Small geographical distance between friends facilitates communication and encourages them to enjoy leisure together. We use information on the county of residence of the peers and the respondent in Wave III (Table 10). We focus on respondents that have both a peer that resides in the same county as them and a peer that resides in different county. This reduces the sample size. The coefficient of the percentage of same-county married friends is not statistically significant. Hence, a mechanism of leisure complementarities does not seem to drive the peer effect on marriage.

The alternative mechanism of search externalities would induce people into marriage through competition on available partners. More specifically, if most of the

friends of an individual are married or cohabit, the set of available partners shrinks and this might make marriage more urgent. However, we have found that the percentage of cohabiting peers does not have any significant effect. We would expect this not to be the case if search externalities were at work.[7]

2.5.2 Wave III nominations: current friends

Up to now we were using friendship nominations from Wave I in order to define the peer group of the respondents. In other words, we were assuming that friendships have lasted throughout the years until Wave III. In this subsection we are going to relax this assumption by updating the friendship information. As we already mentioned, for the respondents of Wave III who were in the 7th or 8th grade at Wave I, an algorithm, based on clubs and activities from previous waves, was used to select 10 names of students who also attended the same school. These respondents were then asked to identify whether or not they were currently or had been previously friends with each of the 10 listed names. We then perform the analysis by using current friends as the peer group of reference. Our sample consists of 1,065 respondents who identified at least one current friend and have non missing own and peer relationship history. Table 11 shows the descriptive statistics for these respondents.[8] To our knowledge this is the first study that uses the friendship information from Wave III of the Add Health survey. One reason for this might be the small sample size. This is not an issue in our case thanks to the retrospective panel of relationships that we have constructed.

We get larger estimates both in the 2SLS and in the fixed effects specification when we repeat the analysis using only the friends that the respondents have identified as current ones (Table 12, columns 1 and 2). The effect is almost double in magnitude (0.057 compared to 0.031 in the fixed effects estimation and 0.133 compared to 0.062 in the 2SLS). This is not surprising given that current friends are expected to exert bigger influence than the whole set of high school friends that contains both current and former friends. There is no clear evidence of spill-over effects from current friends of current friends either (Table 12, column 3). The results in Table 13 regarding the

[7] Another possible mechanism is transmission of information about marriage or cohabitation through peers. However, the absence of spill-over effects from friends of friends (Table 3, column 2) suggests that such a mechanism is unlikely to be at work.

[8] These respondents belonged to the youngest cohort of Wave I, this is why their average age and the % married is lower than those of all the respondents.

transition into cohabitation provide us with a further confirmation of the conformistic mechanism based on the big negative effect of current married peers.

2.6 Robustness

At this point one may think that it is natural to find a positive correlation among individuals that went to the same school and share many common characteristics and thus may doubt about the causality of the peer effect. In order to convince the reader, we perform robustness checks using different groups of peers, namely ghost and placebo friends. The idea behind it is that if the peer effect is spurious it must show up also when considering as peer group of reference individuals with similar characteristics as the real friends who nevertheless are not connected to the respondents.

2.6.1 Ghost friends

The first robustness check uses "ghost" friends as the peer group of reference. We define ghost friends as follows. There are respondents who indicated that they had been previously friends (but not anymore) with some of the 10 names that they were provided with in Wave III. Moreover, we have information on the exact year that the respondent last saw the former friend in person, talked with her on the telephone, or exchanged email. We can thus consider the effect of ghost friends, i.e. the effect of former friends in the years *after* the friendship has ended. We expect that ghost friends should not have any effect on the decisions of the individuals. However, there might be concerns regarding the reasons that the friendship has ended.[9] If the friendship has ended due to the fact that former friends got married, ghost friends would not be adequate for our robustness check. In Table 14 we display the descriptive statistics of ghost friends in comparison with the ones of current friends. We do not observe a bigger tendency towards marriage for ghost friends compared to current friends.

We perform the same analysis using ghost friends instead of current friends. The percentage of married ghost friends does not have a significant effect on the transition of individuals into marriage although the magnitude of the effect is similar to the one

[9] There is a question about the reason why the friendship ended and the most common answer is "it just happened/you drifted apart" among the alternatives: the friend moved away, you moved away, the friend changed, you changed, the friend died.

of real friends (Table 15).[10] This result also alleviates the concern that individuals may chose with whom to remain friends in an endogenous way.

2.6.2 Placebo friends

A further robustness check consists of using placebo friends as the peer group of reference. Remember that in Wave III an algorithm, based on clubs and activities from previous waves, was used to select 10 names of students who also attended the same school. In certain cases the respondents indicated that they did not know some of the 10 names. The unidentified names correspond to individuals that could have been potentially friends with the respondent given that the 10 names were not random, but the algorithm selected them among students of the same school who were doing similar activities with the respondent. Thus, we can exploit this feature of the algorithm and define these unidentified individuals as placebo friends. Table 16 demonstrates that the characteristics of placebo and real friends are similar. Not surprisingly, when we perform the robustness check placebo friends do not have any significant effect either (Tables 17a and 17b, columns 1, for the 2SLS and the fixed effects estimates). The peer effect in the benchmark specifications has not washed out with the reduced sample size corresponding to individuals that have at least one placebo friend (Tables 17a and 17b, columns 2). It is thus actual peers, and not just students from the same school that do matter for the decisions of the respondents. This robustness check is supportive of a causal interpretation of the effect of real friends.

2.6.3 Friends that enter into marriage/cohabitation the year after

The last robustness check concerns the timing of the transition into marriage. As we saw in Table 8, if any peer got married in the previous year, this would affect the transition of the respondent into marriage in the current year. However, we expect that if any peer gets married next year, this will not have any effect on the transition of the respondent into marriage in the current year. Indeed, this is the case as Table 18 shows. Hence, the timing of marriage is indeed contagious.

[10] We may lose statistical significance also due to the small sample size.

2.7 Conclusions

The analysis shows a positive and significant peer effect on the transition of singles into marriage. According to our estimates an increase of one standard deviation in the percentage of friends that are married will increase the individual probability of getting married by 2.2 percentage points. This increase in peer behavior represents an increase in individual behavior of about 5.9 percent of its standard deviation. The effect is present for girls, religious and white people. The fact that there is no significant effect of ghost and placebo friends indicates that real peers do matter. There does not seem to exist a peer effect on the transition into cohabitation. Instead, there is a negative effect of the percentage of married peers on the respondents' transition into cohabitation. This is an indication of a conformistic behavior with respect to marriage. There is no evidence of leisure complementarities or search externalities. The social multiplier has to be taken into account when analyzing the effect of family-friendly policies, tax reforms, divorce laws or other policies that may affect the incentives to get married.

2.8 Tables

Table 1. Individual characteristics in 2002[1,2] (Wave I nominations)

Characteristic	
% females	55.27
Mean Age	22.42
	(0.186)
% cohabiting	19.24
% married	16.94
% African American	10.57
% with >high school education	61.09
Mean Religiosity (7-category scale)	1.95
	(0.089)
Mean Beauty (5-category scale)	3.57
	(0.032)

[1] Individuals with non missing own and peers' relationship history

[2] Corrected for survey design using school as a cluster variable, region as a strata variable, and appropriate weights

Table 2. Determinants of transition into marriage (Pooled OLS and 2SLS)

	(1)	(2)
Specification	Pooled OLS	2SLS
Definition of Peers	Nominated friends	Nominated friends
% married peers	0.023**	0.062**
	(0.011)	(0.030)
% cohabiting peers	0.004	-0.051
	(0.065)	(0.045)
Individual characteristics	Yes	Yes
Parental characteristics	Yes	Yes
Contextual characteristics	Yes	Used as instruments
No of person-years	15,709	14,662
No of clusters	126	126
R^2	0.069	0.054
F-statistic 1st stage	-	18.43; 23.25
J statistic p value	-	0.6214

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used
Individual characteristics: gender, age, education, race, religiosity, beauty, relationship duration, out of wedlock births, Parental characteristics: marital status at Wave I, mother's education, age at first marriage, whether ever cohabited, Excluded instruments: peers' education, religiosity, beauty relationship dur, out of wedlock births, % females, % African Americans, % with married mothers
Year dummies included in all specifications

Table 3. Determinants of transition into marriage (Fixed effects)

	(1)	(2)
Specification	Linear Prob/FE	Linear Prob/FE
Definition of Peers	Nominated friends	Nominated friends of friends
% married peers	0.031**	0.029
	(0.013)	(0.024)
% cohabiting peers	0.009	0.000
	(0.007)	(0.012)
Individual characteristics	Yes	Yes
Parental characteristics	No	No
Contextual characteristics	Yes	Yes
No of person-years	19,629	10,364
No of clusters	130	79
R^2	0.053	0.052

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Individual characteristics (time varying): age, education, out of wedlock births, relationship dur.

Contextual characteristics: average education, and average relationship duration

Year dummies included in all specifications

Table 4. Girls' and boys' determinants of transition into marriage (2SLS and fixed effects)

	Girls		Boys	
	(1)	(2)	(3)	(4)
Specification	2SLS	Linear Prob/FE	2SLS	Linear Prob/FE
Definition of Peers	Nomin. friends	Nomin. friends	Nomin. friends	Nomin. friends
% married peers	0.099**	0.032*	0.039	0.029
	(0.047)	(0.017)	(0.038)	(0.022)
% cohabiting peers	-0.097	0.005	-0.028	0.015
	(0.066)	(0.011)	(0.064)	(0.010)
Individual char.	Yes	Yes	Yes	Yes
Parental char.	Yes	No	Yes	No
Contextual char.	Used as instrum.	Yes	Used as instrum.	Yes
No of person-years	7,956	10,791	6,706	8,838
R^2	0.041	0.051	0.046	0.056
F-statistic 1st stage	12.30; 11.41	-	11.33; 6.12	-
J statistic p value	0.744	-	0.574	-

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Control variables: see Table 2 for 2SLS specification, and Table 3 for FE specification

Table 5. Determinants of transition into marriage (same gender friends)

	(1)	(2)
Specification	2SLS	Linear Prob/FE
Definition of Peers	Same gender friends	Same gender friends
% married peers	0.060*	0.031**
	(0.033)	(0.015)
% cohabiting peers	-0.006	0.008
	(0.042)	(0.009)
Individual char.	Yes	Yes
Parental char.	Yes	No
Contextual char.	Used as instruments	Yes
No of person-years	11,324	15,281
R^2	0.055	0.053
F-statistic 1st stage	18.94; 16.75	-
J statistic	0.666	-

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level)

Control variables: see Table 2 for 2SLS specification, and Table 3 for FE specification

Table 6. Determinants of transition into marriage by characteristic

	(1)	(2)	(3)	(4)
Specification	Linear Prob/FE	Linear Prob/FE	Linear Prob/FE	Linear Prob/FE
Definition of Peers	Religious	Non-religious	High school or less	More than high school
% married peers	0.037***	0.019	0.039*	0.017
	(0.013)	(0.023)	(0.022)	(0.021)
% cohabiting peers	0.010	0.010	0.007	0.010
	(0.008)	(0.013)	(0.011)	(0.013)
Individual char.	Yes	Yes	Yes	Yes
Parental char.	No	No	No	No
Contextual char.	Yes	Yes	Yes	Yes
No of person-years	14,634	4,995	11,016	8,613
R^2	0.058	0.045	0.059	0.049

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Individual characteristics (time varying): age, education, out of wedlock births, relationship dur.

Contextual characteristics: average education, and average relationship duration

Year dummies included in all specifications

Table 7. Determinants of transition into cohabitation (2SLS and fixed effects)

	(1)	(2)
Specification	2SLS	Linear Prob/FE
Definition of Peers	Nominated friends	Nominated friends
% married peers	-0.055*	-0.003
	(0.031)	(0.018)
% cohabiting peers	0.076	0.005
	(0.049)	(0.013)
Individual char.	Yes	Yes
Parental char.	Yes	No
Contextual char.	Used as instruments	Yes
No of person-years	14,408	19,783
No of clusters	126	130
R^2	0.029	0.020
F-statistic 1st stage	19.53; 18.86	-
J statistic	0.717	-

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used
Variables in the FE specification: age, education, rel. duration, peers' average education, rel. duration
Variables in the 2SLS specification: age, race, gender, education, relationship dur, religiosity, beauty, all parental characteristics, Excluded instruments: peers' education, religiosity, beauty, rel. duration, out of wedlock births, % females, % African Americans, % with ever cohabiting mother.
Year dummies in all specifications

Table 8. Determinants of the timing of the transition into marriage (Fixed effects)

	(1)
Specification	Linear Prob/FE
Definition of Peers	Nominated friends
Any peer entered marriage in the previous year	0.032*
	(0.017)
Any peer entered cohabitation in the previous year	0.013*
	(0.007)
Individual characteristics	Yes
Parental characteristics	No
Contextual characteristics	Yes
No of person-years	17,009
R^2	0.048

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Control variables: see Table 3

Table 9. Determinants of the timing of the transition into cohabitation (Fixed effects)

	(1)
Specification	Linear Prob/FE
Definition of Peers	Nominated friends
Any peer entered marriage in the previous year	-0.017*
	(0.010)
Any peer entered cohabitation in the previous year	0.0003
	(0.012)
Individual characteristics	Yes
Parental characteristics	No
Contextual characteristics	Yes
No of person-years	17,170
R^2	0.015

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Control variables: see Table 3

Table 10. Transition into marriage and geographical proximity

	(1)
Specification	Linear Prob/FE
Definition of Peers	Nominated friends
% married peers	0.122**
	(0.046)
% same county married peers	-0.005
	(0.034)
% cohabiting peers	0.043
	(0.040)
% same county cohabiting peers	-0.005
	(0.018)
Individual characteristics	Yes
Parental characteristics	No
Contextual characteristics	Yes
No of person-years	3,352
R^2	0.064

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Control variables: see Table 3

Table 11. Individual characteristics in 2002[1,2] (Wave III nominations)

Characteristic	
% females	49.37
Mean Age	20.61
	(0.036)
% cohabiting	19.20
% married	7.27
% African American	12.71
% with >high school education	50.43
Mean Religiosity (7-category scale)	2.19
	(0.106)
Mean Beauty (5-category scale)	3.56
	(0.047)

[1] Individuals with non missing own and peers' relationship history

[2] Corrected for survey design using school as a cluster variable, region as a strata variable and appropriate weights

Table 12. Determinants of transition into marriage (current friends)

	(1)	(2)	(3)
Specification	2SLS	Linear Prob/FE	Linear Prob/FE
Definition of Peers	Current friends	Current friends	Current friends of friends
% married peers	0.133**	0.057*	0.058
	(0.053)	(0.029)	(0.040)
% cohabiting peers	-0.043	0.013	0.017
	(0.034)	(0.013)	(0.014)
Individual char.	Yes	Yes	Yes
Parental char.	Yes	No	No
Contextual char.	Used as instruments	Yes	Yes
No of person-years	6,637	8,252	2,980
No of clusters	68	70	54
R^2	0.012	0.031	0.021
F-statistic 1st stage	4.95; 10.53	-	-
J statistic	0.897	-	-

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level)

Control variables: see Table 2 for 2SLS specification, and Table 3 for FE specification

Table 13. Determinants of transition into cohabitation (current friends)

	(1)	(2)
Specification	2SLS	Linear Prob/FE
Definition of Peers	Current friends	Current friends
% married peers	-0.171*	-0.056**
	(0.099)	(0.021)
% cohabiting peers	0.016	0.001
	(0.063)	(0.025)
Individual char.	Yes	Yes
Parental char.	Yes	No
Contextual char.	Used as instruments	Yes
No of person-years	6,501	8,081
No of clusters	68	70
R^2	0.058	0.041
F-statistic 1st stage	5.45; 8.16	-
J statistic	0.555	-

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level)

Control variables: see Table 7

Table 14. Real vs ghost friends' characteristics in 2002[1,2]

Characteristic	Real friends	Ghost friends
% married	7.27	8.47
% cohabiting	19.20	20.66
% females	49.37	60.22
Mean Age	20.61	20.63
% African American	12.71	15.07
% with > high school education	50.43	54.18
Religiosity (5-category scale)	2.19	2.06
Beauty (5-category scale)	3.56	3.61

[1] Individuals with non missing relationship history

[2] Corrected for survey design using school as a cluster variable, region as a strata variable and appropriate weights

Table 15. Determinants of transition into marriage (ghost friends)

	(1)	(2)
Specification	2SLS	Linear Prob/FE
Definition of Peers	Ghost friends	Ghost friends
% married peers	-0.057	0.035
	(0.102)	(0.029)
% cohabiting peers	0.054	-0.006
	(0.071)	(0.014)
Individual char.	Yes	Yes
Parental char.	Yes	No
Contextual char.	Used as instruments	Yes
No of person-years	2,897	3,452
No of clusters	67	67
R^2	0.067	0.043
F-statistic 1st stage	4.05; 11.07	-
J statistic	0.914	-

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level)

Control variables: see Table 7

Table 16. Real vs placebo friends' characteristics in 2002[1,2]

Characteristic	Real friends	Placebo friends
% married	7.27	9.71
% cohabiting	19.20	21.16
% females	49.37	60.53
Mean Age	20.61	20.72
% African American	12.71	19.49
% with > high school education	50.43	47.27
Religiosity (5-category scale)	2.19	2.09
Beauty (5-category scale)	3.56	3.55

[1] Individuals with non missing relationship history

[2] Corrected for survey design using school as a cluster variable, region as a strata variable and appropriate weights

Table 17a. Determinants of transition into marriage (placebo friends)

	(1)	(2)
Specification	2SLS	2SLS
Definition of Peers	Placebo friends	Real friends (benchmark)
% married peers	0.024	0.149***
	(0.066)	(0.055)
% cohabiting peers	0.008	-0.045*
	(0.507)	(0.024)
Individual char.	Yes	Yes
Parental char.	Yes	Yes
Contextual char.	Used as instruments	Used as instruments
No of person-years	5,638	5,638
No of clusters	68	68
R^2	0.044	0.022
F-statistic 1st stage	5.61; 16.23	4.45; 9.43
J statistic	0.652	0.717

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level)

Control variables: see Table 7

Table 17b. Determinants of transition into marriage (placebo friends)

	(1)	(2)
Specification	Linear Prob/FE	Linear Prob/FE
Definition of Peers	Placebo friends	Real friends (benchmark)
% married peers	0.002	0.064**
	(0.021)	(0.030)
% cohabiting peers	0.015	0.005
	(0.014)	(0.012)
Individual char.	Yes	Yes
Parental char.	No	No
Contextual char.	Yes	Yes
No of person-years	7,066	7,066
No of clusters	70	70
R^2	0.028	0.034

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level)

Control variables: see Table 7

Table 18. Determinants of the timing of the transition into marriage (Robustness)

	(1)
Specification	Linear Prob/FE
Definition of Peers	Nominated friends
Any peer enters marriage in the year after	0.012
	(0.012)
Any peer enters cohabitation in the year after	-0.004
	(0.006)
Individual characteristics	Yes
Parental characteristics	No
Contextual characteristics	Yes
No of person-years	17,498
R^2	0.065

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weights used

Control variables: see Table 3

2.9 Appendix

Table A1. Sample's characteristics in 2002[1]

Characteristic	All individuals[2]	Sample[3]
% married	17.67	16.94
% cohabiting	21.77	19.24
% females	51.40	55.26
Mean Age	22.59	22.41
% African American	15.04	10.56
% with > high school education	53.05	61.09
Religiosity (5-category scale)	1.92	1.96
Beauty (5-category scale)	3.51	3.58
N	10,220	2,644

[1] Corrected for survey design using school as a cluster variable, region as a strata variable and appropriate weights

[2] Individuals with non missing own relationship history

[3] Individuals with non missing own and friends' relationship history

Table A2. Definition of Variables

Variable	Type	Values
Gender	binary	0 if male 1 if female
Age	continuous	[18, 28]
Race	binary	0 if not African American 1 if African American
Education	binary	0 if high school or less 1 if more than high school
Religiosity (Attendance in religious services)	ordinal	0 never 1 a few times 2 several times 3 once a month 4 two or three times a month 5 once a week 6 more than once a week
Beauty	ordinal	1 very unattractive 2 unattractive 3 about average 4 attractive 5 very attractive
Parental marital status	binary	0 if parents were married in wave I 1 otherwise

Mother's education	binary	$\begin{cases} 0 \text{ if high school or less} \\ 1 \text{ if more than high school} \end{cases}$
Mother's age at first marriage	continuous	[13, 53]
Mother ever cohabited	binary	$\begin{cases} 1 \text{ if the mother has ever cohabited} \\ 0 \text{ otherwise} \end{cases}$
Out of wedlock births	binary	$\begin{cases} 1 \text{ if birth before the 9th month of marriage} \\ 0 \text{ otherwise} \end{cases}$
Relationship duration	continuous	in years (=0 if not currently in a relationship)
Contextual		average of all characteristics

Table A3. IV-Auxilliary Equation

Instrumented: % married peers		
	Coefficient	Std. Error
Gender	-0.0041	0.0109
Age	0.0126***	0.0035
Race	0.0072	0.0438
Education	-0.0013	0.0138
Religiosity	0.0026	0.0035
Beauty	-0.0028	0.0045
Mother married at wave I	-0.0205*	0.0114
Mother's age at first marriage	-0.0035***	0.0010
Mother's education	0.0088	0.0076
Mother ever cohabited	0.0234	0.0156
Out of wedlock birth	0.0025	0.0218
Relationship duration	-0.0016	0.0029
y1995	0.0670**	0.0269
y1996	0.0466**	0.0248
y1997	0.0332	0.0234
y1998	0.0236	0.0211
y1999	0.0282*	0.0163
y2000	0.0247**	0.0104
y2001	0.0283***	0.0060
% female peers	0.0124	0.0125
% African American peers	-0.0871**	0.0428
average rel. duration	0.0465***	0.0060
% peers with out of wed birth	0.2386***	0.0364
% peers with married mother	-0.0233	0.0175
average education	-0.0419*	0.0214
average religiosity	0.0151***	0.0041
average beauty	-0.0150*	0.0082

No of person-years	14,662
R^2	0.278

*** p<0.001, **p<0.05, *p<0.10, rob s.e. clustered at school level

Cross sectional weights used

F test of excluded instruments: F(8,125)=18.43, Prob>F=0.000

Table A4. IV-Auxilliary Equation

Instrumented: % cohabiting peers		
	Coefficient	Std. Error
Gender	-0.0056	0.0101
Age	0.0114***	0.0036
Race	-0.0579**	0.0259
Education	-0.0202*	0.0119
Religiosity	-0.0020	0.0025
Beauty	0.0126**	0.0052
Mother married at wave I	0.0328**	0.0164
Mother's age at first marriage	-0.0010	0.0012
Mother's education	-0.0118	0.0079
Mother ever cohabited	-0.0280	0.0188
Out of wedlock birth	0.0025	0.0230
Relationship duration	0.0038	0.0038
y1995	-0.0179	0.0257
y1996	-0.0092	0.0247
y1997	-0.0022	0.0238
y1998	-0.0009	0.0224
y1999	0.0125	0.0208
y2000	0.0054	0.0153
y2001	0.0144**	0.0068
% female peers	0.0149	0.0121
% African American peers	0.0354	0.0284
average rel. duration	0.0299***	0.0046
% peers with out of wed birth	0.1150***	0.0382
% peers with married mother	0.0263*	0.0151
average education	-0.0364**	0.0141
average religiosity	-0.0142***	0.0023
average beauty	-0.0127	0.0078

No of person-years	14,662
R^2	0.139

*** p<0.001, **p<0.05, *p<0.10, rob s.e. clustered at school level

Cross sectional weights used

F test of excluded instruments: F(8,125)=23.25, Prob>F=0.000

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Chapter 3 Young Adults Living with their Parents and the Influence of Peers (joint with Ezgi Kaya)

3.1 Introduction

There is a growing literature that documents the importance of peer decisions and peer characteristics on individual behavior, mainly focusing on educational outcomes and health decisions. Peer group effects have been shown to be important in academic achievement (Hoxby, 2000; Sacerdote, 2001; Calvó-Armengol, Patacchini and Zenou, 2009; Boucher, Bramoullé, Djebbari, and Fortin, 2010). There is evidence that peers influence individual health decisions such as the use of drugs (Gaviria and Raphael, 2001; Card and Giuliano, 2011), smoking habits (Gaviria and Rafael, 2001; Powell, Tauras and Ross, 2005; Lundborg, 2006; Fletcher, 2010; Card and Giuliano, 2011), alcohol consumption (Lundborg, 2006; Clark and Lohéac, 2007; Fletcher, 2011) and sex initiation (Fletcher 2007, Fernández-Villaverde, Greenwood and Guner 2010; Card and Giuliano, 2011). Recent studies also provide evidence on peer influence on marital decisions (Adamopoulou, 2012), fertility (Kuziemko, 2006; Ciliberto, Miller, Nielsen, and Simonsen, 2010; Hensvik and Nillson, 2010) and the probability of finding a job (Calvó-Armengol and Jackson, 2004; Cappellari and Tatsiramos, 2011). In this paper, we study the influence of high school friends on young adults' living arrangements in the US both in a static and in a dynamic framework. Living arrangements refer to coresidence with parents, i.e., whether the young adult still coresides with at least one parent or no. There is no other study, to our knowledge, that investigates peer group effects on living arrangements of young adults. This study fills this gap in the peer group effects literature.

Leaving the parental home is the first step in the transition to adulthood and it is often associated with economic independence and family formation. As the living arrangements of young adults are closely related to fertility, mobility and labor market outcomes, they have received a lot of attention in the economic literature. Many studies emphasize the importance of leaving the parental home in the life course path

and point out socioeconomic circumstances as determinants of the living arrangements of young adults.[1] Other studies examine the strong heterogeneity across countries regarding the explanatory factors and the timing of leaving the parental home.[2] What emerges in cross country comparisons is that young adults in the U.S. tend to leave parental home relatively earlier than their European counterparts (Yi et al., 1994; Iacovou, 2002). Given that there is a lot of heterogeneity in living arrangements, peer effects may act as a reinforcement mechanism. Our findings add to the literature that focuses on the determinants of the living arrangements of young adults. It is well documented that there are substantial gender, race and socioeconomic class differentials in living arrangements.[3] Women stop living with their parents earlier than men. This is due to differences in the age at marriage but also due to gender differences in the relationship between the parents and the child (Goldscheider and DaVanzo, 1985). Since daughters are commonly monitored by parents more than sons (Ward and Spitze, 1992) and they are expected to do more housework (White, 1994), living with parents after age 18 may be less beneficial for daughters than sons (Goldscheider and Waite, 1991). In terms of racial or ethnical differences, African Americans and Hispanics are substantially more likely than non-Hispanic whites to live in extended families (Beck and Beck, 1984). Moreover, non coresidents are more likely to come from relatively richer and more educated families than coresidents (Rosenzweig and Wolpin,1993). Besides the demographic and socioeconomic characteristics, Ermisch (1999) and Martínez-Granado and Ruiz-Castillo (2002) show that housing market conditions significantly affect the living arrangements of the young in the UK and Spain respectively. Martins and Villanueva (2009) show that limited access to mortgage debt can explain why many young adults in Portugal live with their parents. Peer influence is another issue that remains unexplored. When young adults decide whether to continue living with their parents or move out of the parental home, the

[1] See Eurofond (2006) for the consequences of late emancipation of young adults on future geographic and job mobility; Esping-Andersen (1999), Manacorda and Moretti (2006), Giuliano (2007), Chiuri and Del Boca (2010) for the possible consequences of the late emancipation of young adults in Southern Europe on the labor force participation, unemployment and fertility rate.

[2] See Kiernan (1986) for an international comparison of young adults' living arrangements in Denmark, Great Britain and the United States; Yi, Coale, Choe, Zhiwu and Li (1994) for a comparision of year age-specific net rates of leaving home for men and women in China, Japan, South Korea, the United States, Sweden and France; Iacovou (2002) for living arrangements of young adults in Europe and the United States.

[3] See White (1994) for a review of studies on young adults' coresidence with their parents and their nest-leaving behavior.

nest leaving behavior of their friends might play a role. We add to this strand of the literature, by documenting that also peer behavior has a strong impact on the living arrangements of young adults when demographic, socioeconomic and state level characteristics are accounted for.

One recent paper in the literature that is related to ours is Belot and Ermisch (2009) that study whether friendship ties affect geographical mobility. They develop a model of investment in friendship formation and argue that mobility can destroy friendship ties due to distance, which is costly. Using data from the British Household Panel Survey on singles aged 18-50, they show that people with more close friends are less likely to move. By contrast, we focus on young adults aged 19-29 and their coresidence with parents. Our results are also related to the findings of Giuliano (2007) who studies whether cultural norms matter for the living arrangements of young adults in Western Europe. Using data on the country of origin of second-generation immigrants in the U.S., she finds that in both 1970 and 2000, the living arrangements of second-generation immigrants in the U.S. are similar to the living arrangements of their respective counterparts in the country of origin. We complement her findings by showing that peers also have an impact on living arrangements of the youth. Peer effects is a different dimension of culture than the country of origin. In our analysis, which is not limited to immigrants, we control for parental and racial characteristics and we investigate this further dimension of culture based on peer interactions.

Moreover, in recent years, there has been an increase in the proportion of young adults who are living with their parents (Figure 1).[4] Dyrda, Kaplan, and Ríos-Rull (2012) attribute this increase to the recent crisis that resulted in many young people being unemployed. Unemployed young adults may seek for insurance at their parental home either by not leaving it or by returning to it. In fact, Kaplan (2012) builds a structural model and shows that moving back to the parental home acts as insurance against labor market shocks. We do not try to explain this trend through peer effects. Nevertheless, if there are significant peer effects on the decision of young adults' living arrangements, we expect to observe a further increase in the proportion of young adults living with their parents.

[4]The increase in the percentage of young adults living with their parents was combined with a decrease in geographical mobility of both young females and young males in the U.S., with the decrease being more pronounced for young adults in the age group 18-29. See Figures A1 and A2 in the Appendix.

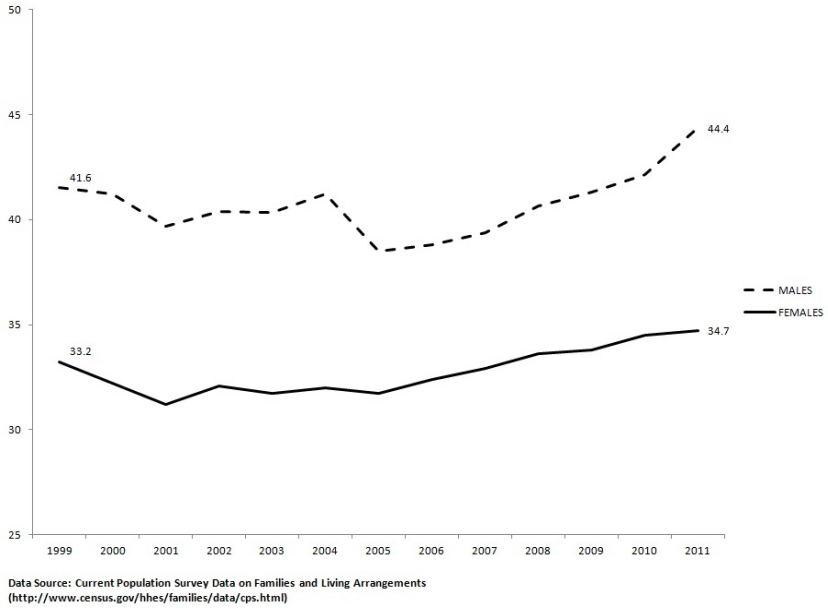

Figure 1. Percentage of males and females aged 18-29 that live with their parents, 1999-2011

We use data from the National Longitudinal Study of Adolescent Health in order to investigate the influence of high school friends on the living arrangements of young adults aged 18-28 in the U.S. To overcome the challenges in identifying peer effects, we first analyze them in a static framework employing instrumental variables techniques. In particular, we use friends' characteristics as instruments for their living arrangements. In the static setting, we consider high school friends and their living arrangements when they are young adults. We estimate cross-sectional regressions in order to quantify the impact of friends since high school on the individual's probability of living with parents during young adulthood. Hence, we regress the percentage of high school friends who live with their parents during young adulthood on the individual's probability to live with his/her parents as a young adult. Then we move to a dynamic framework, where we exploit the differences in the timing of moving out of the parental home for young adults and their friends in order to achieve identification. Our results consistently suggest that there is a significant positive peer effect on the living arrangements of young adults. In particular, an increase of one standard deviation in the percentage of friends that still live with their parents will increase the individual probability of living with the parents by 3.3 percentage points.

3.2 Add Health Data

The data we use in this paper brings together information on high school friends and their coresidence with parents during young adulthood from the National Longitudinal Study of Adolescent Health (hereinafter Add Health).[5] Add Health is a longitudinal study of a nationally representative sample of adolescents in grades 7-12 in the United States during the 1994-95 school year. In 1994-95 the study started with an in-school questionnaire that was administered to more than 90,000 students from 80 high schools and 52 middle schools. A subsample of them (around 20,000) were also asked to complete in-home interviews and were followed in three subsequent waves. The respondents answered questions about their family background, school performance, tobacco and alcohol consumption, criminal activities as well as area of residence and other coresident members of the household. In the first wave respondents were asked to nominate up to five best male and five best female friends. In the same wave, adolescents' parents were also interviewed about family and relationships, and as a result, we can obtain information on their characteristics as well. However, parents were not interviewed in the subsequent waves so it is not possible to update this information.

In this analysis, we use the in-home interview data on adolescents and the information about their friends in 1994-1995 (Wave I) when the adolescents were aged 11-21 and the follow-up data in 2002-2003 (Wave III) when the respondents have become young adults aged 18-28.[6] Given that the median age at leaving parental home is around 21-22 for females and 22-24 for males (Iacovou, 2002) we focus on coresidence with parents when they are at this age.[7] We determine the coresidence with parents

[5]This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

[6]Add Health data have been used in the literature in order to analyze peer effects but most studies focus only on behaviors while at school (Wave I). The only exceptions that study a more dynamic aspect of peer effects using subsequent waves of Add Health are Bifulco, Fletscher and Ross (2011), Pattachini, Rainone and Zenou (2012), and Adamopoulou (2012).

[7]Wave II in-home interviews were conducted in 1996, about one year after Wave I and adolescents in grades 8-12 (aged 11-23) were interviewed. Since in Wave II more than 90% of the adolescents were still below the legal age for children to be released from parental authority, we rather focus on

using the information on the household roster in both waves. Young adults are defined as coresidents with parents, if at least one of the household members is identified as either father, mother's husband, mother's partner, mother, father's wife or father's partner and non-coresident otherwise.[8]

Our sample consists of respondents who completed both Wave I and Wave III in home-surveys and provided information on household roster in both waves. We restrict our sample to respondents who were living at least with one parent in Wave I.[9] In Wave III, we only consider the respondents that live in a private accommodation (with parents, with relatives or non-relatives or living alone) or in a dormitory and we exclude those that are homeless or live in group quarters, whose behavior might reflect necessity and not a voluntary decision. Finally, we restrict the sample to those who provided usable information for at least one nominated friend.

Information on friendships comes from Wave I (either from the in-home or the in-school questionnaire). As mentioned before, in Wave I, data collectors assigned an identification number to each student and provided a list of all students to the respondents in order to identify up to five male friends and up to five female friends. On average, each respondent has nominated 5.9 friends. We do not have information on out-of-school friends because of the Add Health sampling frame. However, the number of out-of-school friends was quite small (less than 1 friend, 0.8 per respondent). We did not require that nominations were mutual when constructing the peer group of reference for each respondent. Those that the respondent nominated as friends are likely to influence him/her even if they, in turn, did not nominate him/her as a friend. As long as nominated friends were also interviewed (i.e. they were part of the random subsample who completed the in-home survey), one can construct for each respondent a set of friends with detailed Add Health information. Given that the data represent a subsample of students within schools, not all nominated friends are interviewed and

the living arrangements in Wave III. On the other hand, Wave IV in home interviews were conducted in 2007-2009, almost 14 years after Wave I, and the respondents were 24-34 years old. However, it is unlikely that high school friendships are maintained for so many years after high school. Hence, we study peer effects in Wave III, only 8 years after Wave I, when friendships are more likely to still hold. There is very limited information on whether high school friends are still friends in Wave III. However, there is clearly a selection issue regarding the continuation of friendships after high school. Therefore, we consider all friends that the respondents nominated in Wave I.

[8] Mother and/or father can be biological, step, adoptive or foster.

[9] More than 94 percent of the adolescents in Wave I were living with at least one parent (14,247 of 15,088 valid cases).

as a result, the measures of friends' characteristics will be imperfect. However, since the sampling scheme for the in-home interview was random, the measures should be on average correct. On average, each respondent has 2.2 nominated friends who were also part of the survey.

Our final sample consists of 3,949 respondents with non missing coresidence information that have at least one friend with non missing coresidence information as well. Table 1 shows the descriptive statistics for those still coresiding with their parents when they are young adults and for non-coresidents.[10] The category of coresidents includes also those that might have changed place of residence together with their parents and continued living with them in the new place of residence and the ones who might have moved out from parental home between Wave I and Wave III but have returned back home and co-reside with their parents in Wave III.

In line with findings from earlier studies Table 1 shows that, compared to non coresidents, coresidents are mostly men, single, and younger. Moreover, coresidents are more likely to be Hispanic or African American, without college education, and not employed. Parental characteristics also make a difference in living arrangements of young adults; non coresidents are more likely to come from relatively richer and more educated families than coresidents. Lastly, the relationship of the respondents with their parents during adolescence differs for coresidents and non-coresidents.[11]

3.3 Identification issues

Our outcome of interest is the coresidence of young adults with their parents. To determine the peer group effects on young adults' coresidence with parents, our benchmark regression is as follows:

$$l_{is} = \overbrace{\gamma \bar{l}_{-is}}^{\text{endogenous effects}} + \underbrace{\sum_{m=1}^{M} \beta_m x_{is}^m}_{\text{individual char.}} + \underbrace{\frac{1}{g_i} \sum_{m=1}^{M} \sum_{j=1}^{n} \theta_m g_{ij} x_{js}^m}_{\substack{\text{average peer char.} \\ \text{(gender, age, etc)}}} + \alpha_s + \varepsilon_{is}, \quad (1)$$

[10] For the description of variables see Table A.2 in the Appendix.

[11] The descriptive statistics of the individuals in our final sample are similar to the ones of all the individuals interviewed in Wave III, ensuring that the final sample is still representative. See Table A1 for a comparison with the descriptive statistics of the full sample in Wave III.

where l_{is} is the binary variable for the coresidence status of young adult i living in state s. l_{is} takes the value 0 if a young adult who was living with at least one parent when she/he was adolescent is not living with the parents anymore, and the value 1 if she/he continues living with at least one parent. $\bar{l}_{-is}$ is the percentage of peers (nominated friends, or same grade students from the same block in Wave I) that live with their parents during young adulthood, excluding individual i, and γ is the coefficient of interest, i.e. the peer effect that we are trying to estimate. x_{it}^m is a vector of family and individual characteristics with parameter vector β_m that might act as determinants of young adults' coresidence behavior as we discuss in the next subsection. The parameter vector, θ_m captures contextual effects, i.e. the influence of the average peer characteristics on young adult's coresidence status. For this purpose, we define g_{ij} as the indicator function that reflects the direct connection of two individuals in a friends' network g with $N = \{1, ..., n\}$ members. Hence, two individuals i and j are directly connected if and only if $g_{ij} = 1$. We set $g_{ii} = 0$ since an individual cannot be a friend of herself. Finally g_i is defined as $g_i = \sum_{j=1}^{n} g_{ij}$,which is the size of the direct connections of individual i. The set of direct connections of individual i is $N_i(g) = \{j \neq i \mid g_{ij} = 1\}$, which is of size g_i and unless the network is complete and everybody is a friend of everybody, the size of the direct connections are individual specific ($N_i(g) \neq N_j(g)$).[12] Finally α_s are state dummies that capture the state specific fixed effects that may influence the living arrangements of young adults.

3.3.1 Individual characteristics

Our vector of individual characteristics, x_{it}^m includes several types of covariates. These variables include gender, age, and race of the respondents as there are many gender and racial differences in living arrangements (Goldscheider and DaVanzo, 1985; Ward and Spitze, 1992; Chiuri and Del Boca, 2010; and Beck and Beck, 1984). In line with the findings of these studies, we expect males to be more likely to live with their parents than females, younger individuals to co-reside with their parents more than older ones, and Hispanics or African Americans to be more likely to co-reside with their parents than White Americans. In addition to these standard demographic variables, we include four more set of variables in the x_{it}^m vector.

[12] See Jackson (2008) for further details.

The first set of these additional variables includes parental income and parental education. As shown in the literature these variables are influential in the coresidence behavior of young adults (Rosenzweig and Wolpin, 1993; Goldscheider and Waite, 1991; and White, 1994). Rosenzweig and Wolpin (1993) show that non coresidents come from relatively richer and more educated families than coresidents. Hence, we expect the probability of coresiding with parents to increase with the parental education and parental income. Due to the survey design of the AddHealth, this set of variables comes from Wave I because the parents were interviewed only then.

Another set of additional variables that we control for tries to capture the relationship of the young adult with her/his parents when she/he was an adolescent. Our prediction is that if the young adult had a bad relation with the parents or used to do many household chores when she/he was young, this would make her/him less likely to continue living with the parents during young adulthood. The variables that we include are the amount of housework that the respondents used to do in Wave I, and how good the respondents were considering their relationship with the parents by then.

Furthermore, earlier literature documents that family formation and (un)employment are key determinants of living arrangements (Iacovou, 2002; Kaplan, 2012). Our last set of variables tries to capture the effects of these current socioeconomic status of the young adult, namely the marital status, employment status, and college attainment (completed or ongoing).[13] We expect that the probability of living with parents will be higher for single, unemployed and young adults with no college attainment.

Finally, we also include state dummies, α_s that, among others, capture the characteristics of local housing markets that affect the living arrangements of young adults (Ermisch, 1999; Martínez-Granado and Ruiz-Castillo, 2002; and Martins and Villanueva, 2009).

3.3.2 Identifying the peer group effects on living with the parents

Individual behavior may move conjointly with average peer group behavior for three different reasons. i) Endogenous effects; the behavior of the individual is causally influenced by the behavior of the group. This is the peer group effect that we are interested in. ii) Contextual effects; the behavior of the individual is influenced by

[13] For the detailed description of variables see Table A.2 in the Appendix.

the characteristics of the group. iii) Correlated effects; the individual and the group behave in the same way due to similar environments that are unobserved or due to endogenous friendship formation/sorting. This arises either from the fact that both the individual and her friends are subject to common unobserved shocks, due to institutional environments or because the individual selects friends who are similar to her.

Manski (1993) shows that identifying the endogenous and the contextual effects separately in a reduced form linear model is not possible. This is called the reflection problem and it is due to the fact that by definition group behavior is the aggregation of individual behavior. Solutions that have been proposed in order to solve the reflection problem consist of using instrumental variables techniques, or using panel data (see Bramoullé, Djebbari, and Fortin, 2009; Boucher et al., 2010). Instruments are used in order to generate variation in peer behavior that is independent from individual behavior. Examples of identification strategies with instrumental variables include Ciliberto et al. (2010) that use the fertility of the siblings of one's colleagues as an instrument for the fertility of one's colleagues, and Fletscher (2011) that uses the alcohol consumption of the parents of one's classmates as an instrument for the alcohol consumption of one's classmates. The basic idea is that siblings or parents of peers affect the behavior of the peers but have no independent effect on the respondent's behavior. De Giorgi, Pellizzari, and Redaelli (2010), and Pattachini and Zenou (2012) exploit the information about the whole network of friendships and instrument the behavior of the respondent's friends with the characteristics of friends of friends who are not directly linked with the respondent.

In our static model, we instrument the percentage of peers living with parents using the contextual variables which is a common procedure in the literature (e.g. Gaviria and Raphael, 2001; Powell et al., 2005). We hence assume that there is no direct effect of friends' characteristics on respondents' decisions ($\theta_m = 0$) and use friends' characteristics as instruments for their living arrangements.[14] Then we move to a dynamic framework and exploit differences in the timing of the move in order to

[14]In our setting, information on friends of friends is very limited as we need information for both the respondents and their friends in Wave III. Hence, it is necessary that they have all completed in-home interviews. As Figure A3 shows in the Appendix, when using in-home nominations, nominated friends who did not complete in-home interviews were not able to nominate anyone. This is not the case when we use in-school nominations (Figure A4). However, this information on friends of friends is irrelevant given that the behavior of friends that we would like to instrument is still missing.

achieve identification and check the robustness of our results. In this framework the living arrangements of the friends are already determined at the time that we observe the behavior of the respondent, and the reflection problem is mitigated without the use of instruments. In order to obtain unbiased estimates we need to assume that the individuals are not forward looking. They are affected only by the past actions of their friends.

What about correlated effects? One might worry that people make new friends as they get older. Hence, it is normal for people who live without their parents to make new friends who are also similarly behaved. In this case endogeneity would be a serious problem in identifying the peer effect. In the current analysis we consider friends since high school. This solves part of the endogenous friendship formation in later years. Moreover, it is not very likely that adolescents selected friends in high school according to characteristics that determined their living arrangements afterwards.[15] On the other hand, we also control for Wave I state-level fixed effects in order to overcome the endogeneity of the state of residence in Wave I. In this way we also control for unobserved state-level characteristics, e.g. welfare policies, mobility promoting programs, availability of college etc, that could jointly affect the living arrangements of the respondents and their peers.[16]

3.4 Results

3.4.1 Static models

Wave I In-Home Nominations.[17] We first examine the determinants of living arrangements of young adults aged 18-28 using the high school friend nominations.

[15] The respondents in Wave I were asked whether they wanted to leave parental home. This could reflect either a preference for independence or the fact that the neighborhood was not good. By using information on whether the parent wanted to change neighborhood we define as independent children those who wanted to leave parental home although their parent did not want to change neighborhood. We do so also for their friends and we then compute the correlation between each child's preference for independence and peer preference for independence (homophily in terms of independence). The correlation coefficient is 0.10. This is much smaller than homophily in terms of gender (0.35) or parental income (0.53).

[16] Since the nominated friends are not necessarily living in the same block, tract or county, we control for state fixed effects to overcome the problem that may arise due to correlated effects.

[17] The respondents were asked to nominate their best friends both in the in-school and in the in-home interview. We present the results using the in-home nominations given that the presence of other students in the school might have influenced the in-school nominations of the respondent. Nevertheless, we also estimated all the specifications using the in-school nominations and the results were very similar.

Here, we assume that friendships have lasted after high school (i.e. from Wave I to Wave III for 7-8 years). As explained in the previous section, our dependent variable takes the value 0 if a young adult who was living with at least one parent when she/he was adolescent is not living with the parents anymore, and the value 1 if she/he continues living with at least one parent. The variable of interest is the ratio of each individual's friends that live with their parents. We include as regressors the characteristics of the individuals, such as age, gender, race, marital status, employment status, college attainment, amount of housework used to do in Wave I, how good was the relationship with the parents, maternal income and education as we discussed above.

We start with a simple linear probability model (Table 2, column 1) and we find a statistically significant peer effect.[18] However, the results of a simple OLS without fixed effects might suffer from the identification problems that we discussed above. We therefore perform 2SLS in a linear probability model using the contextual variables as instruments and including Wave I state fixed effects (Table 2, column 2).[19] We assume that the contextual variables do not have any direct effect on individual behavior, i.e. $\theta_m = 0$ and we exclude them from the regression.[20] Instead, we use these contextual variables as an instrument for the percentage of peers who live with their parents in Wave III. We omit the contextual variables that are very correlated with individual characteristics, i.e., those related to race, age and gender. We hence use as instruments the proportion of peers that had a good relationship with their parents, average housework, parental education and parental income of peers measured at Wave I as well as the proportion of peers that are single, employed, and completed or attend college in Wave III. Under the assumption that contextual effects are non-existent, there should be no direct relationship between individual i's behavior and the average background characteristics of individual i's peers. Hence, we expect that the relationship of individual i's peers with their parents when they were adolescents, as well as the education and income of their parents affect the coresidence behavior of individual i's peers but not the decision of individual i to coreside with his/her parents. Moreover,

[18] We also calculated marginal effects for a logit estimation as a consistency check. Both the magnitude and significance of the coefficients remained unchanged.

[19] See Table A4 in the Appendix for the results of the full specification.

[20] Indeed, when we included contextual variables in the OLS regression none of them was statistically significant.

college attainment/attendance and the marital and employment status of the peers of individual i should determine the decision of the peers to coreside with their parents but not the decision of individual i directly.

The F statistic of the excluded instruments in the 1st stage is larger than 10 indicating that the instruments are not weak.[21] The Hansen J statistic does not reject the hypothesis of the validity of the instruments. There is a statistically significant positive peer effect.

Same grade students living in the same block in Wave I. In this section, as a robustness check, we define an alternative group of peers. Given that we study mobility decisions, defining the peer group of reference using the residential proximity in Wave I can also be of relevance. Hence, instead of using the friends that the respondents nominated in Wave I we define the peer group of reference for each respondent as the students who were enrolled in the same grade (but potentially in different schools) and lived in the same block as the respondent in Wave I. This peer group of reference is a combination of neighbors-grademates and it is particularly relevant in this setting. Furthermore, defining the peer group of reference in this way allows us to overcome possible concerns regarding selection and endogenous friendship formation. We perform 2SLS using the contextual characteristics as an instrument (Table 3, column 1). The results of this estimation are comparable with the results presented in Table 2, column 1.

As Table 3 shows, the peer effect is again positive and significant. In the last specification we also add grade fixed effects on top of state fixed effects in order to capture unobserved cohort shocks (Table 3, column 2).[22] The results are robust.

Discussion of the IV estimates. As we mentioned above, OLS suffer from the reflection problem. We thus use an instrumental variable approach in order to correct the upward bias in OLS estimates. However, our 2SLS estimates are larger than the OLS estimates. One explanation could be that peer-group behaviour was measured with error and instrumenting for peer behaviour also helped reducing the downward bias due to those measurement errors. However, since we constructed the peer group

[21] Table A3 in the Appendix displays the results of the 1st stage regression.

[22] See Tables A5 and A6 in the Appendix for the results of the 1st stage regression and the results of the full specification.

average using the household roster for each peer there is no reason to believe that there is measurement error in the instrumented variable. Another explanation lies on the nature of our instruments. Other studies that use contextual variables in order to instrument peer group behavior also find larger estimates in the 2SLS specification (Gaviria and Rafael,2001; Lundborg,2006; Fletscher, 2011). It is not clear that the contextual characteristics are legitimate instrumental variables for peer behavior, even if they have no independent causal effect on individual behavior. This is why we move to a dynamic specification where we mitigate the reflection problem using the time dimension instead of instrumental variables.

3.4.2 Some dynamics

In Wave III the respondents were also asked to fill in a calendar of geographical mobility with all the states they have lived in and the month and year of the move. This calendar contains information about all the states that the respondent has lived in during his life, the year and month of the move to each state and to the current address. However, there is no information on other coresiding members (parents, partners or friends) so as to know whether the respondent moved together with the parents or no. In order to make use of the dynamic component of the data we assume for those respondents who were not living with the parents in Wave III that the date they moved out of the parental home for the first time coincides with the date of the move to the current address. In other words, we assume for the respondents who changed residence between Wave II and the date of the move to the current address that parents were also moving with them. Only the last move to the current address corresponds to individuals moving out alone. Actually, 71.51% of the respondents moved to the current address in the last 3 years, i.e. between 1999 and 2001, when they were on average 20.75 years old. This is very similar to the age by which 50% of young adults have left parental home in the U.S. (Iacovou, 2002). Hence, our assumption is likely to hold.[23]

In this framework we can exploit differences in the timing of the move in order to achieve identification. In particular, using information on the month and year that people moved to the current address, we treat as non-coresidents only the friends that

[23]Figure A5 in the Appendix depicts the details of our assumption.

moved out of the parental home before the respondent. We thus treat the friends that left the parental home after the respondent as coresidents with their parents. The fact that these friends left the parental home after the respondent suggests that they were still living with the parents at the time the respondent moved out of the parental home. Hence friends can be either coresidents (never moved out of the parental home or did so after the respondent) or non coresidents (moved out of the parental home before the respondent). In this way, the living arrangements of the friends are already determined at the time that we observe the behavior of the respondent, and the reflection problem is mitigated without the use of instruments.

Table 4, column 1 presents the results of the OLS regression of this dynamic model, which are also in line with the estimates of the static model.[24,25] In particular, the estimated coefficient of the peer effect is statistically significant and equal to 0.076. How large is the estimated effect? In our sample the mean of the variable of interest (% of friends that still live with their parents) is 0.65 with a standard deviation of 0.44. According to our estimates an increase of one standard deviation in the percentage of friends that still live with their parents will increase the individual probability of living with the parents by 3.3 percentage points. This increase in peer behavior represents an increase in individual behavior of about 6.8 percent of its standard deviation (which is 0.49). This effect is not negligible.

3.4.3 Heterogeneous effects

But who are the ones who are influenced by their peers? Is there a group of individuals that is totally unaffected? In order to answer this question we analyze separately different groups of individuals with respect to gender and parental income. Table 5 presents the results of the dynamic model by gender. The peer effect on girls is large and statistically significant. The peer effect on boys, although similar in magnitude to the one on girls, is not statistically significant. This is probably due to the splitting of the sample. Therefore, there is no strong evidence that peers influence the living arrangements of girls more than the living arrangements of boys or vice versa. The picture is much more clear in the case of parental income though. We run

[24] See Table A7 in the Appendix for the results of the full specification.

[25] We also estimated the dynamic model including school fixed effects and the peer effect remained significant at 10% percent level but decreased a bit in magnitude (0.051).

the dynamic model separately for young adults coming from relatively wealthy families (parental income above the median) and for young adults coming from relatively poor families (parental income below the median). There is a very large peer effect only on young adults that come from relatively wealthy families (Table 6). By contrast, the living arrangements of young adults coming from relatively poor families are completely unaffected by peers. This result might reflect the fact that one can actually move out of the parental home only if there are enough financial resources.

3.5 Conclusions

Decreased geographical mobility of young adults can have several consequences on unemployment and growth. We study the recent increase in the percentage of young adults living with their parents in the U.S. which might be associated with the decrease in their mobility. We use data on high school friends and we make use of instruments and state fixed effects in order to mitigate the problems of identification. We find that peers play an important role in determining the living arrangements of young adults in the U.S. In particular, an increase of one standard deviation in the percentage of friends that still live with their parents will lead to an increase of 3.3 percentage points in the individual probability of living with the parents. Policy makers should take this peer effect into account when evaluating policies that are intended to boost youth emancipation or mobility.

3.6 Tables

Table 1. Descriptive Statistics by Coresidence with Parents

Characteristic	Non Coresidents	Coresidents	All
% females	55.24	47.92	52.24
% White	79.19	70.88	75.79
% African-American	10.85	12.33	11.46
% Hispanic	6.97	10.89	11.94
Wave III variables			
Mean Age	21.86	21.03	21.52
	(1.78)	(1.72)	(1.80)
% single	56.32	89.53	69.93
% with college education	68.03	64.04	66.39
% employed	74.18	73.58	73.94
Wave I variables			
% good relationship with a parent in Wave I	79.07	84.62	81.35
Mean amount of housework in Wave I	2.14	2.02	2.09
(4-scale category)	(0.85)	(0.88)	(0.86)
Mean parental income in Wave I	52.26	47.05	50.10
(thousand dollars)	(51.76)	(35.05)	(45.65)
Mean parental education	1.77	1.65	1.72
(4-scale category)	(0.99)	(0.99)	(0.99)
%	59.02	40.98	100.00
Number of obs.	2,266	1,683	3,949

Notes: Standard errors in parenthesis. The sample includes young adults who were living with at least one parent in Wave I, with non missing own and high school friends' coresidence information.

Corrected for the design effects of the Add Health sampling process.

Table 2. Determinants of living arrangements in Wave III, static model

Definition of Peers	Nominated friends	Nominated friends
	(1)	(2)
Specification	OLS	2SLS
% peers living with parents	0.062**	0.152*
	(0.029)	(0.084)
Individual char.	Yes	Yes
Parental char.	Yes	Yes
Contextual char.	No	Used as instruments
Wave I State fixed eff.	No	Yes
No of observations	2,792	2,358
R^2	0.229	0.161
F-statistic 1st stage	-	37.95
J statistic p-value	-	0.284

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weight used

Control variables: age, gender, race, marital status, employment status, college attainment, amount of housework used to do in Wave I, how good was the relationship with the parents in Wave I, maternal income and education

Table 3. Determinants of living arrangements in Wave III, different peer group

Definition of Peers	Students from the same grade who lived at the same block in Wave I	
	(1)	(2)
Specification	2SLS	2SLS
% peers living with parents	0.184*	0.204**
	(0.097)	(0.102)
Individual char.	Yes	Yes
Parental char.	Yes	Yes
Contextual char.	Used as instruments	Used as instruments
Wave I State fixed eff.	Yes	Yes
Wave I Grade fixed eff.	No	Yes
No of observations	2,960	2,960
R^2	0.210	0.178
F-statistic 1st stage	27.17	24.11
J statistic p-value	0.343	0.439

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weight used

Control variables: age, gender, race, marital status, employment status, college attainment, amount of housework used to do in Wave I, how good was the relationship with the parents in Wave I, maternal income and education

Table 4. Determinants of living arrangements in Wave III, dynamic model

Definition of Peers	Nominated friends
	(1)
Specification	OLS
% peers living with parents	0.076***
	(0.026)
Individual char.	Yes
Parental char.	Yes
Contextual char.	No
Wave I State fixed eff.	Yes
No of observations	2,792
R^2	0.236

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weight used

Control variables: age, gender, race, marital status, employment status, college attainment, amount of housework used to do in Wave I, how good was the relationship with the parents in Wave I, maternal income and education

Table 5. Determinants of living arrangements in Wave III, dynamic model by gender

Definition of Peers	Nominated friends	Nominated friends
	(1)	(2)
	Females	Males
Specification	OLS	OLS
% peers living with parents	0.076**	0.064
	(0.030)	(0.042)
Individual char.	Yes	Yes
Parental char.	Yes	Yes
Contextual char.	No	No
Wave I State fixed eff.	Yes	Yes
No of observations	1,474	1,318
R^2	0.247	0.260

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weight used

Control variables: age, gender, race, marital status, employment status, college attainment, amount of housework used to do in Wave I, how good was the relationship with the parents in Wave I, maternal income and education

Table 6. Determinants of living arrangements in Wave III, dynamic model by parental income

Definition of Peers	Nominated friends	Nominated friends
	(1)	(2)
	Wealthy parents	Poor parents
Specification	OLS	OLS
% peers living with parents	0.126***	0.014
	(0.036)	(0.038)
Individual char.	Yes	Yes
Parental char.	Yes	Yes
Contextual char.	No	No
Wave I State fixed eff.	Yes	Yes
No of observations	1,392	1,400
R^2	0.241	0.301

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e. clustered at school level), cross sectional weight used

Control variables: age, gender, race, marital status, employment status, college attainment, amount of housework used to do in Wave I, how good was the relationship with the parents in Wave I, maternal income and education

3.7 Appendix

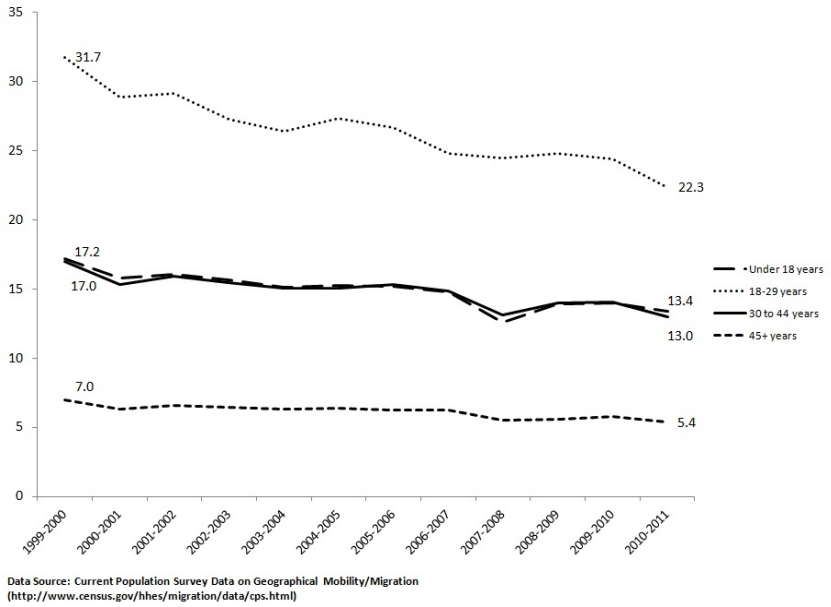

Figure A1. Percentage of movers[26]by age group, 1999-2011

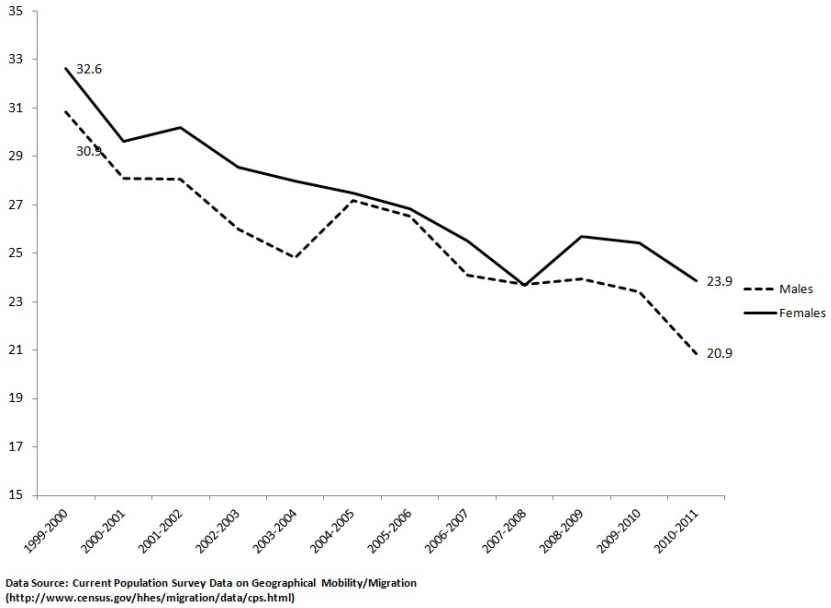

Figure A2. Percentage of movers aged 18-29, by gender, 1999-2011

[26]The population is classified according to mobility status by the U.S. Census Bureau on the basis of a comparison between the place of residence of each individual to the time of the March survey and the place of residence one year earlier. All people who were living in a different house at the end of the period rather than at the beginning are classified as movers.

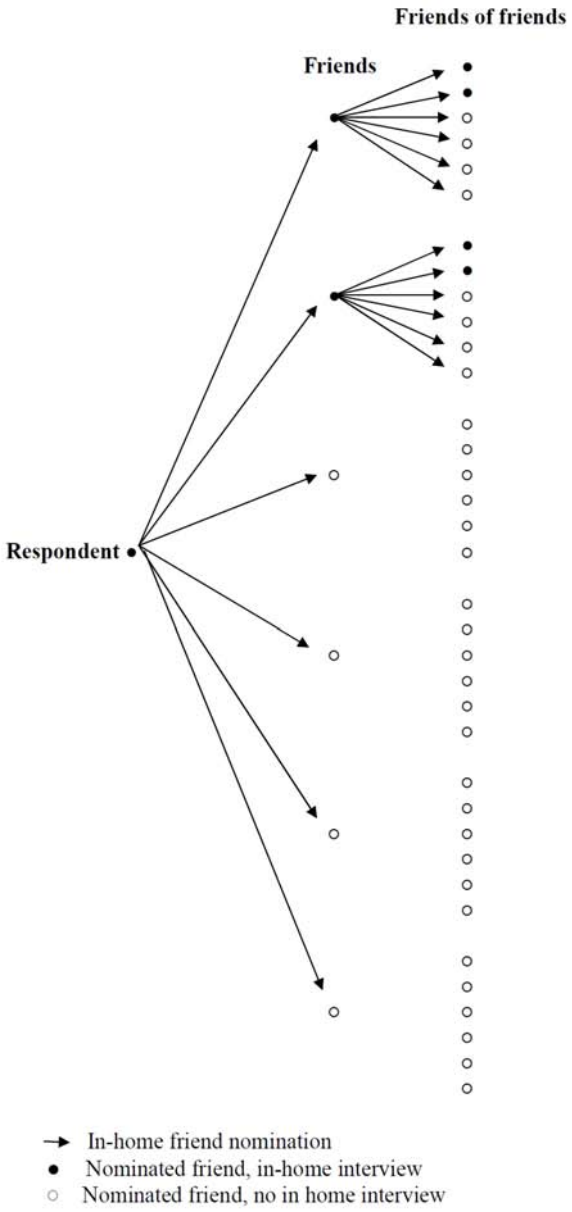

Figure A3. In-home nominations and in-home interviews

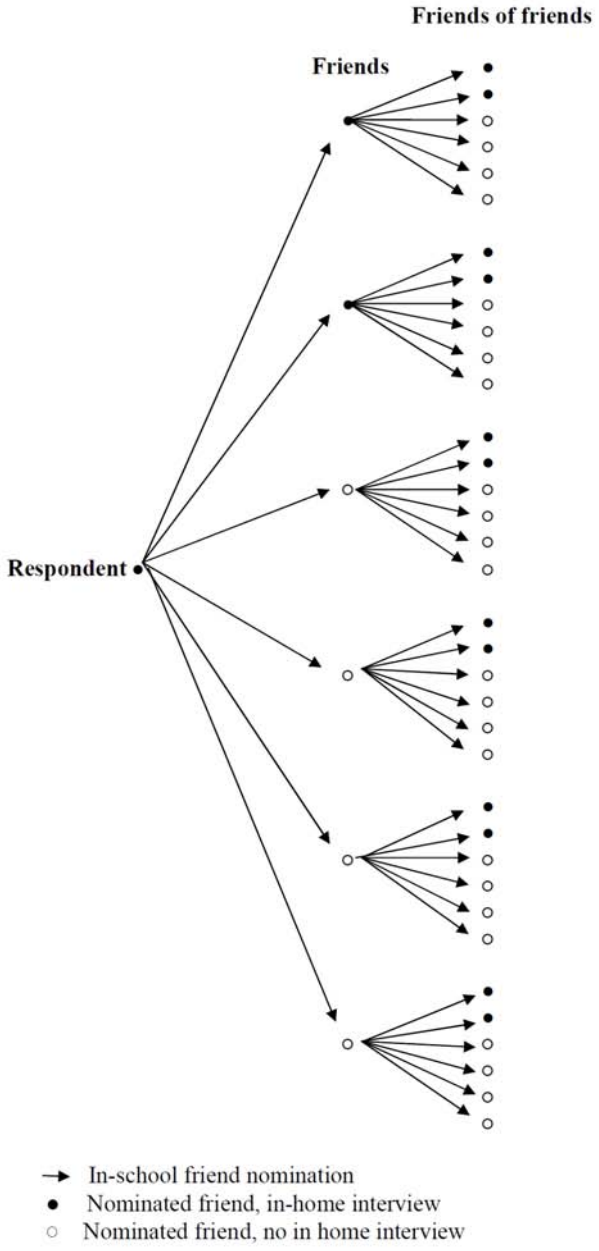

Figure A4. In-school nominations and in-home interviews

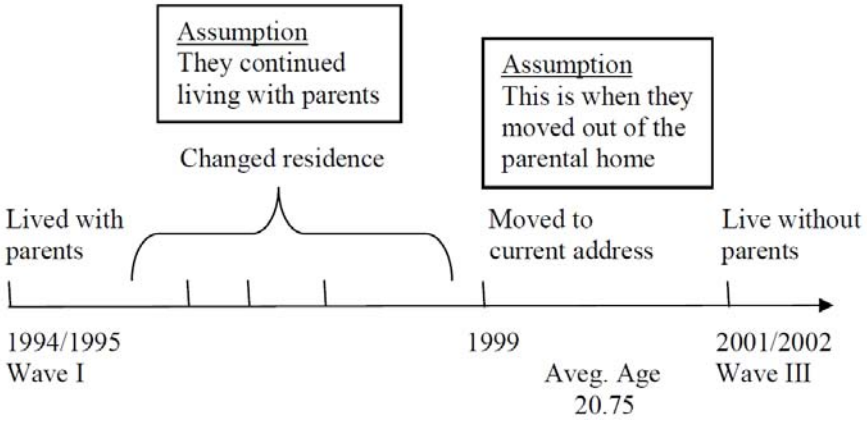

Figure A5. Assumption for the dynamic model

Table A.1. Descriptive Statistics, Full Sample

Characteristic	All
% females	49.21
% White	68.01
% African-American	15.88
% Hispanic	11.94
Wave III variables	
Mean Age	21.82
	(1.87)
% single	66.76
% with college education	57.35
% employed	74.36
Wave I variables	
% good relationship with a parent in Wave I	80.16
Mean amount of housework in Wave I	2.04
(4-scale category)	(0.89)
Mean parental income in Wave I	45.74
(thousand dollars)	(45.17)
Mean parental education	1.58
(4-scale category)	(1.01)
%	
Number of obs.	14322

Notes: Standard errors in paranthesis. Sample based on Wave III of Add Health. Corrected for the design effects of the Add Health sampling process. The target population for this sample is comprised of young adults in 2001, who were enrolled in US schools during the 1994-1995 academic year for the specified grades.

Table A2. Definition of Variables

Variable	Type	Values
Gender	binary	0 if male 1 if female
Age	continuous	[18, 28]
Hispanic	binary	0 if not Hispanic 1 if Hispanic
African American	binary	0 if not African American 1 if African American
Single	binary	0 if married or cohabiting 1 if single
College	binary	0 if no college 1 if completed college or currently in college
Employed	binary	0 if not employed 1 if employed
Well with parent in Wave I	binary	0 if bad relationship with both parents in wave I 1 if good relationship with one parent in wave I
Housework in Wave I	ordinal	0 not at all 1 1 or 2 times per week 2 2 or 3 times per week 3 5 or more times per week
Total household income in Wave I	continuous	in thousand $

Parental education	ordinal	0 Less than highschool 1 Highschool or similar 2 More than highschool 3 College or more

Table A3. IV-Auxilliary Equation-Nominated friends

Instrumented: % peers living with parents		
	Coefficient	Std. Error
Gender	0.011	(0.021)
Age	-0.037***	(0.007)
African American	0.023	(0.059)
Hispanic	0.054	(0.052)
Other race	0.135*	(0.078)
Single	-0.015	(0.050)
Employed	0.022	(0.041)
Single*employed	0.009	(0.056)
College	-0.019	(0.027)
Housework	-0.001	(0.012)
Well with parent	0.019	(0.027)
Parental Education	-0.026*	(0.014)
Parental Income	0.0001	(0.0002)
% single peers	0.396***	(0.028)
% employed peers	0.100***	(0.035)
% peers with college education	-0.123***	(0.037)
% peers well with their parent	0.044	(0.040)
average housework of peers	-0.024	(0.018)
average parental education of peers	-0.016	(0.015)
average parental income of peers	-0.0004	(0.0004)
No of observations	2,358	
R^2	0.199	

*** p<0.001, **p<0.05, *p<0.10, rob s.e. clustered at school level

Cross sectional weights used

F test of excluded instruments: F(7,128)=37.95, Prob>F=0.000

Table A4. Full Specification (2nd Stage)-Nominated friends

	Coefficient	Std. Error
% peers living with parents	0.152*	(0.084)
Gender	-0.005	(0.029)
Age	-0.029**	(0.011)
African American	-0.009	(0.059)
Hispanic	0.040	(0.035)
Other race	0.139**	(0.058)
Single	0.222***	(0.057)
Employed	-0.118**	(0.054)
Single*employed	0.170***	(0.062)
College	-0.086***	(0.029)
Housework	-0.042**	(0.016)
Well with parent	0.048	(0.029)
Parental Education	-0.014	(0.014)
Parental Income	-0.0003	(0.0003)
No of observations	2,358	
R^2	0.161	

*** p<0.001, **p<0.05, *p<0.10, robust s.e. clustered at school level

Cross sectional weights used

Table A5. IV-Auxilliary Equation-Different peer group

Instrumented: % peers living with parents		
	Coefficient	Std. Error
Gender	0.005	(0.010)
Age	-0.007	(0.007)
African American	-0.023	(0.031)
Hispanic	-0.021	(0.028)
Other race	-0.023	(0.039)
Single	0.010	(0.022)
Employed	0.003	(0.018)
Single*employed	0.012	(0.024)
College	-0.008	(0.011)
Housework	0.003	(0.006)
Well with parent	-0.019*	(0.011)
Parental Education	-0.001	(0.005)
Parental Income	-0.000	(0.000)
% single peers	0.472***	(0.044)
% employed peers	0.068	(0.047)
% peers with college education	-0.077	(0.050)
% peers well with their parent	-0.015	(0.045)
average housework of peers	-0.022	(0.024)
average parental education of peers	-0.049***	(0.020)
average parental income of peers	-0.000	(0.000)
No of observations	2,960	
R^2	0.175	

*** p<0.001, **p<0.05, *p<0.10, rob s.e. clustered at school level

Cross sectional weights used

F test of excluded instruments: F(7,95)=24.11, Prob>F=0.000

Table A6. Full Specification (2nd Stage)-Different peer group

	Coefficient	Std. Error
% peers living with parents	0.204**	(0.101)
Gender	-0.027	(0.034)
Age	-0.063***	(0.021)
African American	0.035	(0.046)
Hispanic	0.032	(0.044)
Other race	0.020	(0.068)
Single	0.278***	(0.054)
Employed	-0.128**	(0.055)
Single*employed	0.190***	(0.063)
College	-0.082***	(0.024)
Housework	-0.036***	(0.013)
Well with parent	0.009	(0.037)
Parental Education	-0.037***	(0.012)
Parental Income	-0.0004**	(0.0002)
No of observations	2,960	
R^2	0.178	

*** p<0.001, **p<0.05, *p<0.10, robust s.e. clustered at school level

Cross sectional weights used

Table A7. Full Specification (Dynamic model)-Nominated friends

	Coefficient	Std. Error
% peers living with parents	0.076***	(0.026)
Gender	-0.024	(0.029)
Age	-0.040***	(0.009)
African American	0.031	(0.055)
Hispanic	0.043	(0.037)
Other race	0.141***	(0.053)
Single	0.240***	(0.057)
Employed	-0.012**	(0.051)
Single*employed	0.152**	(0.063)
College	-0.083***	(0.025)
Housework	-0.042***	(0.015)
Well with parent	0.047*	(0.027)
Parental Education	-0.020	(0.012)
Parental Income	-0.0004*	(0.0002)
No of observations	2,792	
R^2	0.231	

*** p<0.001, **p<0.05, *p<0.10, robust s.e. clustered at school level

Cross sectional weights used

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